3.0 Worker Safety and Health

Overall, the site has maintained a good worker safety and health record when compared to both industry and other DOE facilities, even with the high level of D&D and restoration work activities in progress. The workforce is generally motivated and competent, and performs a significant amount of work in a safe and professional manner. The level of work activities, especially in D&D, remediation, and reindustrialization, is likely to increase, thereby increasing the risk to workers.

The work control structure is more complex at ETTP than at many other DOE facilities. The complex relationships between DOE and the multiple contractors performing work at the site present many unique challenges to workers, supervisors, and managers to fully implement integrated safety management (ISM) down to the task level. A large number of prime contractors, subcontractors, and reindustrialization leasees are on site and must work together under numerous contracts, subcontracts, leases, agreements, safety plans, work control systems, and procedures. The hazard analysis and control implementation processes are likewise complicated. Workers often encounter different requirements as they perform similar tasks across organizational boundaries. These multiple and complex processes sometimes result in workers failing to properly perform work in accordance with adequately identified controls.

Table 6 identifies contractors and subcontractors that received some level of review during the course of this investigation. Numerous other subcontractors perform work at ETTP.

In addition to Bechtel Jacobs, DOE's management and integrating contractor, DOE has several prime contractors who all use several lower tier subcontractors. Some lower tier contractors, such as JA Jones, the site maintenance services contractor, perform work for Bechtel Jacobs, for most DOE prime contractors and subcontractors, and for many reindustrialization lessees. JA Jones also provides labor-only support to many

Table 6. Contractor and Subcontractors Observed

Contractor/Subcontractors/ Lessees	Prime/Sub	Activity
BNFL, Inc.	DOE Prime	Decontamination and Decommissioning of K-29, K-31, and K-33
M&EC	DOE Prime & CROET Tenant	Decontamination and Decommissioning of K-1200, tenant K-1024
Decon Recovery Services	DOE Prime	Decontamination and Decommissioning of K-1420 Building
CROET	DOE Lessee	ETTP reindustrialization
Bechtel Jacobs Corporation	DOE M&I	ETTP M&I contractor, cylinder management
Safety and Ecology Corporation	BJC 3 site sub	BJC ETTP radiological support
JA Jones	BJC ETTP sub	Site services maintenance. Subcontractor to many site organizations
ATI/FMSIT	BJC ETTP sub	Facility Operations, Insp., Surveys, and Testing
Entech	BJC ETTP sub	K-25 equipment encasement project
IT Corporation	BJC WO sub	Operates the TSCA incinerator
Radian	BJC WO sub	CNF operation, surface impoundments A & B
Integrated Environmental Solutions	BJC WO sub	Operates TCGRS gas cylinder project.
WESKEM	BJC LW sub	Legacy waste disposition, storage and transport
Operations Management, Inc.	CROET contractor	Utilities – steam, H_2O plant, sewer, fire water (except power)
MK Ferguson	M&EC sub	Miscellaneous maintenance/construction
Sharp & Associates	BJC 3 site sub	General construction services
ICF Builders and Consultants	BJC ETTP sub	General construction services
Westinghouse Safety Management	BJC 3 site sub	Criticality and HAZMAT safety analysis

Note: WO is waste operations. LW is legacy waste. BJC is Bechtel Jacobs.

organizations. DOE also has prime contracts or leases with BNFL, DRS, M&EC for D&D, and the Community Reuse Organization of East Tennessee (CROET) for reindustrialization. In some cases, the same company may act both as a DOE prime contractor and as a CROET lessee.

The investigation team observed work activities; performed walkdowns; reviewed corporate and plant procedures, program documents, work packages, occurrences, and assessment reports; and interviewed managers, supervisors, workers, job planners, and ES&H personnel. The team was able to observe work and review programs for the DOE prime contractors, most direct subcontractors, and several lower-tier subcontractors and vendors. Typical work activities observed included:

- BNFL D&D work and radiological practices at the K-33 building
- Bechtel Jacobs/Entech encapsulation project at the K-25 building
- Air Technologies, Inc./Facility Management Surveillance Inspection and Test (ATI/FMSIT) surveillance inspections of the K-25 building and filter testing
- Bechtel Jacobs/JA Jones UF_6 cylinder relocation
- CNF operations by Bechtel Jacobs/Radian
- Decontamination by DRS at the K-1420 building
- Cylinder bottle operations by Bechtel Jacobs/IES
- Waste handling and sampling by Bechtel Jacobs/ WESKEM at K-1065 buildings
- Excavation and utility work at K-1303 and K-1001 by Bechtel Jacobs/JA Jones with involvement of Operations Management, Inc. (OMI)
- Fire main valve maintenance and repair by CROET/OMI near the K-33 building
- Limited work activities by IT Corporation at TSCA, including waste repackaging operations at K-1423
- Waste packing in gondola cars for transportation by rail by WESKEM
- Routine corrective maintenance by JA Jones in the K-1400 building
- HEPA filter replacement by Bechtel Jacobs/IT Corporation in K-1032
- Health physics preparations for radiological work on the K-1004L roof.

The investigation team identified significant issues in work control, conduct of operations, lockout/tagout (LO/TO), radiological protection practices, and occupational safety and health programs. The weaknesses indicate that many existing programs are neither mature nor adequately integrated. Training weaknesses and some cultural issues are hindering adherence to established requirements. The team observed some instances of unsafe work practices involving contractors and subcontractors. These weaknesses indicate needed improvements to ensure that workers are adequately protected from radiological and industrial hazards and that exposures to chemical and radiological materials are maintained ALARA. As at Paducah and Portsmouth, the investigation team identified deficiencies in the site's ability to effectively control radiological work due to a lack of rigor and discipline in the radiation work permitting process.

These deficiencies indicate that DOE, prime contractors, and subcontractors have not fully implemented integrated safety management and the five core functions ensuring adherence to established requirements during the performance of work.

3.1 Work Control Programs

The investigation of work control systems included an examination of selected work control processes used by DOE prime contractors, the management and integrating contractor and subcontractors, and lower-tier subcontractors who perform work for a variety of contractors and subcontractors on site. CROET activities involving reindustrialization were generally not included in the investigation scope. However, the CROET contractor OMI operates and maintains the fire water system, the steam plant, sanitary water plant, and sewer plant. OMI must also interface with facility

Fencing Work - Reindustrialization Boundaries

managers, building operators, and JA Jones workers during many work activities. Because these work activities can affect DOE nuclear, radiological, and industrial facilities, the investigation team performed a limited evaluation of some OMI work activities.

The team found that all contractors and most subcontractors had formal work control programs and procedures in place that required hazard identification and analysis, documented work packages, and work instructions, with necessary reviews and approvals to proceed with work activities. Contracts, subcontracts, work smart standards, and health and safety plans (HASPs) generally provide the requirement framework for performing work. The number of contractors and large number of subcontractors resulted in a variety of different work control processes.

Managers, supervisors, and workers had a good understanding of "stop-work" authority and responsibility. The contractor and subcontractor work control programs had specific stop-work procedures, and most work packages addressed stop-work in the prerequisites or work instructions. Workers interviewed across a broad range of organizations indicated that they would not hesitate to stop work for safety reasons and would feel no intimidation for doing so. Subcontractors stopped work on several occasions during the investigation for conditions that were considered unsafe or were in question.

The ATI/FMSIT organization established and is implementing a well-defined work planning and control program. Work observed by the team was performed safely. Work packages were developed and implemented in accordance with procedures and addressed the five core functions of ISM. Routine surveillance and inspection procedures clearly defined the work scope and acceptance criteria. The hazards of the work were identified, documented, and acknowledged by workers. Controls defined in permits and pre-job hazard briefings were appropriate. Some areas for improvement were identified. Work supervisors verified worker qualifications to perform the work; however, procedures require the verification to be performed by the Training Coordinator. Post-job briefings were conducted, but were not always documented and attached to the completed work package as required.

BNFL has established an effective work control process covering a high level of D&D activities (about 500 to700 personnel and 24-hour per day operations). The formal enhanced work planning (EWP) procedures include defining the scope of work, specific prerequisites and limitations (called bounding conditions), pre-job hazard briefings, job hazard analyses (JHAs) linked to work steps, lessons learned, and formal post-job reviews. A pre-job briefing for changes in an EWP procedure for seal exhaust removal indicated appropriate consideration of industrial hygiene hazards, respirators, personal protective equipment, and monitoring requirements. The supervisor and workers discussed lessons learned from previous work. EWP packages for converter and compressor disassembly, pipe removal, and duct removal were comprehensive. The scope of work was well defined, hazards were listed, and appropriate hazard controls were specified. The sequential work instructions were well written, with the appropriate level of detail. However, in the past 15 months, BNFL has had several occurrences, a near miss, a Type B Accident Investigation, and a safety stand down of all ETTP operations due to a series of work injuries. After those events, BNFL completed a number of corrective actions including management changes, revised work control programs, and additional training. BNFL's safety is improving and the recordable injury rate is decreasing. However, a stop-work for a subcontractor during this investigation period involving inadequate hazard analysis and failures to follow procedures indicates that continuing problems with subcontractor oversight. Because this recent event follows completed corrective actions and recurrence control from previous similar occurrences, additional actions by management are warranted.

JA Jones is a maintenance service subcontractor for Bechtel Jacobs, but also performs extensive work for all site contractors and subcontractors under separate contracts or agreements. JA Jones performs work for about ten Bechtel Jacobs subcontractors and about 25 other ETTP contractors, subcontractors, and

reindustrialization lessees onsite. JA Jones also supplies labor to other contractors, such as IT Corporation, who work under their work control procedures. Therefore, some workers operate under multiple work control systems, depending on which subcontractor has procured their services. In many cases, the work control procedures have common elements driven by contracts, work smart standards, and ES&H plans. These elements typically include similar procedures for permitted activities (e.g., welding, confined space, LO/TO, excavation, and radiation work permits), some type of documented work package, an activity or job hazard analysis and, similar training requirements. The investigation team identified a number of deficiencies in routine work packages, LO/TO, and excavation program implementation as discussed in Table 7.

Table 7. Unsafe Work Practices

Deficiencies: The investigation team identified examples of unsafe work practices and work planning deficiencies during the investigation. There were several instances where the investigation team or contractors/subcontractors stopped work, including one apparent unsafe condition for M&EC/MK Ferguson roof work.

M&EC (CROET Lessee)/MK Ferguson Fall Protection at Building K-1023: The investigation team observed a MK Ferguson subcontractor to M&EC performing work on a pitched roof (low slope) approximately 50 feet above the ground without fall protection. Fall protection or safety barriers were not in place as required by M&EC procedure IS-WTC-03, "Fall protection and Elevated Work," for workers performing "hands on" work. Based on an apparent "unsafe" condition, the work was stopped by the investigation team. Discussion with the worker and M&EC building contacts indicated they believed they did not require fall protection, as they were doing an inspection. They did not consider the inspection a work activity, although tools were used and a roof vent canopy was disconnected and raised. The worker stated the roof was in bad shape; however, the worker and M&EC building contact indicated they had not verified or had someone verify that the roof was structurally safe before allowing workers on the roof. Signs near ladders to the roof warned of roof degradation. M&EC had recently had the roof inspected, but apparently, M&EC building contacts and workers were not informed. Because the activity was considered an inspection, a documented work scope, work instructions, pre-task hazard forms, or a work package was not used. The roof inspection was being performed by MK Ferguson for M&EC in their role as a CROET lessee under reindustrialization. Subsequent discussions with the MK Ferguson ES&H Manager indicated that an investigation of the incident was in progress.

Bechtel Jacobs/JA Jones Excavation at Building K-1303: The OMI disconnect permit for an excavation was not coordinated with the excavation permit approved by the facility manager. The facility manager and work crews were at the job site ready to perform job pre-briefings when it was discovered the disconnect permit indicated a different cut location for a fire water line. The facility manager appropriately placed the job on hold to resolve the difference. The investigation team considered the suspension of work appropriate and timely. Subsequent investigation by the team identified that there is no procedure for the OMI disconnect permit and procedures do not adequately address coordination among one or more subcontractors working on the same job. Although work had not commenced, deficiencies in work planning and coordination between subcontractors resulting in stopping the job.

Bechtel Jacobs/JA Jones Excavation Work at Building K-1303: Work was kept on hold when the investigation team identified failures to mark the location of underground utilities on the ground as required by the Bechtel Jacobs procedure SH-A-2004, "Excavation/Penetration Permit." The "clear zone" for digging where excavation was safe was also not marked. Discussions with the heavy equipment operators, workers, and supervisors indicated that utilities, other than power, had never been marked on the ground, an apparent recurring violation of the excavation procedure. The equipment operators, workers, supervisor, and safety advocate did not adequately understand or enforce excavation procedure requirements. Additionally, the lessons learned from numerous excavation events across the DOE complex have not been adequately captured in excavation procedures and training. There are numerous past complex-wide events where failure to adequately mark all buried utilities and to clearly mark safe excavation zones have caused near misses, equipment damage, and personnel injury.

OMI/JA Jones LO/TOs: The OMI LO/TO procedure requires that the supervisor of the work crew (subcontractors performing the work) verify by signature that the isolation provides adequate protection for safely performing work. The OMI LO/TO procedure provides no guidance on how to verify LO/TO. LO/TO deficiencies identified by the investigation team, and the Bechtel Jacobs safety advocate/DOE site office safety representative indicate that OMI and JA Jones supervisors have not been performing adequate LO/TO verifications. Inadequate verifications place workers at

risk. Work packages reviewed did not fully address coordination issues among multiple subcontractors. Training programs or procedures should adequate address the verification process to preclude unsafe LO/TOs.

Bechtel Jacobs/JA Jones and OMI LO/TOs: JA Jones placed work on hold at Building K-1303 when a Bechtel Jacobs Safety Advocate and a DOE safety representative identified a deficient LO/TO on a fire main valve during a joint walkdown. The LO/TO did not ensure positive control of the valve as required by 29 CFR 1910.147 and the OMI LO/TO procedure. The chain and lock were attached such that the valve could still be operated using another valve handle. The LO/TO was initially installed by OMI and verified safe for work by a JA Jones supervisor. After OMI reported the problem corrected, Bechtel Jacobs re-inspected the valve and found that the lockout was still inadequate. OMI was informed and subsequently found the correct locking type handle for the valve and corrected the lockout. Additionally, the investigation team identified that hydrants under LO/TO were open to provide a vent path, but the hydrant caps necessary to complete the vent path were off, and not under LO/TO as required. Lockout tags on standpipes to underground valves were not firmly attached as required by the 10 CFR 1910.147 and the OMI LO/TO procedure.

CROET/OMI LO/TO Near Building K-33: The investigation team stopped CROET/OMI work on a fire main valve replacement in an excavation near the K-33 Building when the team identified that the utility subcontractor had been performing work under an unsafe LO/TO. The team performed additional LO/TO walkdowns because of the serious deficiencies identified at Building K-1303. The walkdowns identified one isolation valve with an unlocked LO/TO red lock, one valve where the lock was not through one end of the chain, and hydrants used as vent paths where the hydrant caps were not under LO/TO. A large number of fire water post isolation valves had defective or missing position indicators due to deferred maintenance. Because of these LO/TO deficiencies, CROET ordered a 48-hour stop work, retraining of all workers involved in LO/TO, and a 100% verification of all LO/TOs.

OMI Cooler Isolation in Building K-1101: After the 100% verification by OMI, the investigation found workers/supervisors had added two LO/TO tags to an existing lubricating oil cooler LO/TO. The LO/TO tags were added after the authorizing authority had approved the LO/TO, and after the work supervisor verified the LO/TO safe for workers. The issuing authority did not reauthorize the LO/TO after the tags were added and the work supervisor did not sign the LO/TO as reverified before performing work under the LO/TO. The addition of the tags raised safety concerns about the adequacy of the original LO/TO and work planning for the job. The addition of tags to the LO/TO without re-approval was in violation of the OMI LO/TO procedure. This condition was promptly corrected by OMI.

WESKEM Waste Sampling in Building K-1065B: WESKEM personnel lifted a 5,900-pound ST5 container with a forklift rated at 5,500 pounds when a container of batteries was moved into a contamination area. One worker and an industrial hygiene supervisor were in the work area without safety shoes. One worker without safety shoes was performing a survey on a lifted load with his feet under the plane of the load. His feet remained under the load as the load was lowered to a point where he could survey the top of the 55-gallon drums on the pallet being lifted. 29 CFR 1910.178(m)(2) requires that no person shall be allowed to stand or pass under the elevated portion of any truck, whether loaded or empty. Additionally the forklift drivers did not sound horns at cross isles and locations where vision was obstructed in accordance with 29 CFR 29.1978 (n)(4). The work package, activity hazard analysis (AHA), and referenced WESKEM procedure WD-WTS0-OP-2015, Routine Waste Transportation and Storage Activities do not adequately address movement of heavy containers with forklifts. The initial Non-Conformance Report (NCR), prepared for the overlift, incorrectly described the overlift and the cause, did not require evaluation of forklift operability, and did not address inadequacies in work planning that contributed to the overlift. Consequently, the NCR was subsequently withdrawn and rewritten.

WESKEM/Turnkey Gondola Car Work: Investigation team members observed drums being swung in close proximity over workers using their hands to tend to drums above their heads. 10 CFR 1910.184(c)(9) requires that all employees be kept clear of suspended loads about to be lifted. 29 CFR 1910.180(h)(4)(ii) requires that no person should be permitted to stand or pass under a load on a hook. When questioned, the supervisor appropriately stopped the job and re-instructed workers before allowing work to proceed. One forklift operator was not wearing safety glasses as required by the activity hazard analysis. A few days later, on the same job, the gondola car struck a crane due to work planning deficiencies in placement of the crane. Additionally, two weeks later, the team observed workers on the elevated gondola car immediately adjacent to an unprotected edge about eight feet above the ground without fall protection. The workers were standing on both sides of the gondola car placing a tarp over the waste drums with their backs toward the unprotected edges. The AHA for the job did not address fall protection for working on top of the gondola car. Work was immediately stopped.

WESKEM has performed waste sampling, disposition, repackaging, sampling, and transportation under the Bechtel Jacobs contract since January 2000. WESKEM also operates and maintains waste storage areas such as Building K-1065. WESKEM work control programs and activities are evolving, and a number of program and performance deficiencies were identified as discussed in this section and in Section 3.4.

OMI supports both DOE-owned facilities and reindustrialization leased facilities. OMI has implemented a formal work control system with approved procedures. The work control system guides definition of work, work package preparation, a safety permitting process (e.g., LO/TO, welding/burning, confined space, stop work) that if properly implemented would provide adequate controls to perform work safely. The OMI work control program and performance were adequate, with one exception. The investigation team identified serious deficiencies in training of workers and the implementation of the LO/TO program.

The team identified a number of significant issues indicating that management has yet to effectively implement ISM at ETTP (DOE prime contractors, subcontractors, and a CROET contractor). The investigation team identified weaknesses in the implementation of ISM core functions that contributed to the unsafe work practices identified in Table 7 and other deficiencies identified below. Collectively, this indicates the presence of training weaknesses and some cultural issues, resulting in numerous failures to enforce and follow established requirements and procedures while performing work.

Issues

Issue 7. Inadequate implementation of work control programs by DOE, Bechtel Jacobs, other prime contractors, and CROET/OMI resulted in inadequate hazard identification and analysis, inadequate implementation of established controls, and failure to follow approved procedures that contributed to several unsafe work practices observed by the investigation team.

- **Weaknesses in ISMS Core Functions 1, 2, and 3.** Deficiencies were identified in subcontractor work packages including inadequate work definitions, job planning, and work instructions; lack of documented post-job testing; and failures to follow procedures for preparing and completing work packages (see also Sections 3.2, 3.3, and 3.4).

- Inadequate work planning and control by WESKEM and a failure to evaluate the weight of a container and fork lift capacity in accordance with training requirements for equipment operators, resulted in a fork lift being subjected to an overload exceeding the capacity of the fork lift.

- Work planning deficiencies and lack of adequate coordination between the ATI building operator/ excavation permit issuing authority, JA Jones, and OMI resulted in stopping an excavation job because the excavation permit and utility disconnect permit showed different locations for an excavation. The ATI Issuing Authority coordinated the overall review of the excavation permit with Bechtel Jacobs engineering (Theta Corporation), Bechtel Jacobs environmental compliance, the Bechtel Jacobs facility manager, Bechtel Jacobs subcontract technical representatives, OMI utilities, JA Jones power operations, and the JA Jones excavation work group supervisor. Work planning and procedures/ agreements did not result in adequate coordination between subcontractors.

- OMI had no procedure for implementing their utility disconnect permit form that shows the location to cut and disconnect utilities, although this work had potential to affect DOE-owned nuclear, radiological, and industrial facilities.

- Several JA Jones work packages had deficiencies in work scope, work instructions, and the JHAs and activity hazard analyses required to perform work. One work step stated "reenergize the motor and remove the LO/TO." Many preventive maintenance jobs, such as heating, ventilating, and air conditioning (HVAC) maintenance, were not covered by preventive maintenance procedures or manufacturer instructions. One job with a work scope covering only Building K-1400 had work instructions to replace filters in other buildings. Work instructions and the referenced JHAs did not provided instructions for capping utility disconnects. Some of these discrepancies had been previously identified by the Bechtel Jacobs subcontractor technical representative in an April 2000 audit and were being tracked in the JA Jones tracking system.

- WESKEM work packages had deficient work instructions. Unclear work instructions resulted in workers undoing the container latches without industrial hygiene support being present to sample for explosive gases as planned. Discussions with the lead industrial hygienist and technician indicated that the intent was to have industrial hygiene take samples, as the latches were undone. Inadequate work instructions/planning resulted in overloading a forklift as indicated in Table 7.

- Post-maintenance testing and functional checks were rarely preplanned, required, or documented in JA Jones work packages.

- **Weaknesses in ISMS Core Function 4.** Adequate hazard controls were not implemented or followed to ensure worker safety for several work activities.

  - M&EC fall protection requirements for work at the K-1023 Building were not adequately implemented by MK Ferguson, resulting in a potential unsafe work condition.

Pipe Removal Maintenance/D&D

  - JA Jones excavation work at K-1303 was not performed in accordance with the excavation and LO/TO procedures.

  - OMI supported work at Building K-1303 and OMI work on the fire main near Building K-33 were performed under inadequate LO/TOs with potential risk to workers.

  - For an OMI/JA Jones Building K-1001 steam line disconnect in a high-risk confined space, OMI used single valve protection where double valve protection was readily available. A JA Jones supervisor had verified the LO/TO as safe for work and the work was performed under single valve isolation. Although not required by the Occupational Safety and Health Administration (OSHA), neither subcontractor considered double valve protection desirable for the work. As a reason, supervisors indicated that the reach-rod-operated steam block valves did not operate well.

  - Contrary to the JHAs, a worker, and lead industrial hygienist in K-1065B were not wearing steel-toed shoes. A worker involved in loading a gondola car was not wearing required safety glasses, and on a different day, two workers were not wearing hardhats as required by the JHA. The deficiencies indicated inattention to JHA requirements and lack of supervision at the job site.

- **Weaknesses in ISMS Core Function 5.** Deficiencies in feedback and improvement resulted in lost opportunities to improve work control programs, training, and work safety.

  - Lessons learned from complex-wide events associated with LO/TO and excavation had not been adequately captured by training programs and procedures.
  - Numerous past DOE-complex-wide events regarding excavation addressed the importance of clearly marking the location of buried utilities and excavation “clear” zones. However JA Jones workers, supervisors, and a Bechtel Jacobs safety advocate did not understand or enforce procedural requirements for utility marking.

- Serious LO/TO concerns have been a continuing DOE issue, yet lessons learned from complex wide events has not resulted in the appropriate safety culture, training, and oversight to result in adequate LO/TOs.

- A WESKEM non-conformance report (NCR) to address the forklift overlift was incorrectly prepared and may not have resulted adequate corrective action and recurrence controls as originally written.

- Critiques and investigations of unsafe work practices were not thorough indicating deficiencies in conduct of operations elements.

As a result of the identified weaknesses and discrepancies, DOE, contractors, and subcontractors have taken a number of corrective actions and compensatory measures to correct discrepancies identified by ETTP personnel and the investigation team. As examples, JA Jones and OMI stopped all work under LO/TOs to verify all LO/TOs were safe. OMI did not recommence work until workers and supervisors had been retrained, and the ES&H Manager had personally verified all LO/TOs. Bechtel Jacobs stopped all work by subcontractors under OMI LO/TOs and issued an immediate lessons-learned to all Bechtel Jacobs subcontractors, recognizing that they often work under utility LO/TOs. A number of other corrective actions were in progress based on the site and investigation team's findings.

Conclusion

Formal work control systems are in place for DOE prime contractors and most subcontractors. Documented work packages are used for most routine and non-routine work and generally have appropriate review and ES&H involvement. With noted exceptions, the work force and supervision are knowledgeable and perform work safely. The understanding of rights and responsibilities to stop work and the refusal to perform unsafe work for safety questions is a strength at all organizational levels and for all contractors and subcontractors reviewed. Workers, supervisors, and safety personnel appropriately demonstrated stop-work authority on several occasions during the investigation period. Interviews indicated that safety was a priority over production and schedule. The implementation of processes and methods to ensure coordination and communications between the various contractors and subcontractors is evolving. Although most work activities were conducted safely, deficiencies in several areas require immediate management attention. Deficiencies in work planning and work package development and implementation affected performance of work in the field. The investigation team identified serious deficiencies in LO/TO and fall protection that placed workers at risk. The team concluded that strict adherence to procedures would have averted all identified unsafe work practices, and most identified deficiencies in work planning and work packages.

3.2 Operations/Procedures

The investigation team examined a number of operations and work activities across several prime contractors and subcontractors to determine the rigor exercised in the conduct of operations. The review examined whether work was being performed in accordance with procedures and work instructions. Activities observed included waste repackaging for burning in the TSCA incinerator and Building K-1423 rounds/inspections by IT; uranium encapsulation in the K-25 building by Entech; K-25 building floor panel inspections by Commodore; K-25 building surveillance, inspection, and filter testing activities by ATI/FMSIT; plan of the day meetings, HVAC duct removal, converter and compressor disassembly, and pipe removal and size reduction in K-33 building by BNFL; final release survey activities in K-1420 by DRS; ETTP

Building K-25 at Southwest Corner

shift superintendent activities by Bechtel Jacobs; and shift turnover at CNF by Radian. The team also examined a range of work packages, procedures, logs, safety basis documents, and unreviewed safety question determinations.

OR chose not to include DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, or an equivalent set of requirements in any ETTP contracts as mandatory requirements. Consequently, the rigor and discipline of operations at ETTP varies among contractors and subcontractors. Some procedures, such as Bechtel Jacobs cylinder handling procedures, were of high quality. At the K-33 Building, work instructions for enhanced work planning packages for converter and compressor disassembly were comprehensive and sufficiently detailed to safely perform the work. Pre-job briefings with several of the contractors were comprehensive and addressed all hazards of the jobs. In other areas, the conduct of operations was unsatisfactory. Before implementation of the Work Smart standards, when DOE Order 5480.19 was still a contract requirement, the CNF was recognized as a good example for conduct of operations implementation. Recently, however, lacking the conduct of operations contract requirements, Radian, with concurrence of Bechtel Jacobs, removed the requirement for face-to-face shift turnovers, a longstanding and beneficial practice, thereby increasing the risk of communication errors and potential incident/accidents. Other conduct of operations elements are also deficient. Numerous LO/TO violations occurred within DOE prime contractors and subcontractors during this investigation (see Section 3.1). Bechtel Jacobs and ATI do not implement the Building K-25 basis for interim operations (BIO) with the rigor expected by DOE Order 5480.19 driven conduct of operations program. For example, Bechtel Jacobs cancelled a program required by the K-25 Building BIO without analyzing the effect on the safety basis as required by the unreviewed safety question determination (USQD) process.

Issue

Issue 8. The failure of OR to include DOE Order 5480.19 or equivalent requirements as a part of the Work Smart standards for the ETTP prime contractors and subcontractors has resulted in numerous conduct of operations problems in several areas, including shift turnover, procedural compliance, and lockout/tagout. OR has not included DOE Order 5480.19 as a requirement in the Work Smart standards of any of the prime contractors on site. In some cases, the order has been included in the contract as a guideline; however, minimal expectations for its use have been provided. Consequently, prime contractor and subcontractor application of conduct of operations guidelines is not adequate in some areas. Poor conduct of operations practices are significant precursors to accidents across the complex. The following examples illustrate both programmatic and implementation deficiencies at ETTP:

- OR has not encouraged and enforced rigorous abnormal event investigation and notifications among the various prime contractors and subcontractors. DOE Order 5480.19 provides minimum expectations for programs to address investigation of abnormal events (Chapter 6) and events requiring notifications to DOE or outside agencies (Chapter 7) beyond the expectations described in DOE Order 232.1A. During this investigation, the investigation team observed or became aware of numerous abnormal events that resulted in work stoppages or interruptions, but were not properly investigated and reported to DOE as would be required by DOE Orders 5480.19 and 232.1A. See Section 4.0 for further details.

- Bechtel Jacobs issued a policy and is implementing a procedure addressing rigor and discipline of operations rather than implementing DOE Order 5480.19. Bechtel Jacobs uses DOE Order 5480.19 as guidance, but leaves it up to the managers of projects as to whether any DOE Order 5480.19 requirements beyond the basic policy statements apply for a given facility. Project managers decide if they should implement any of the specific requirements from DOE Order 5480.19 and if so, how these requirements will be incorporated into subcontracts. The policy and associated implementing procedure do not encourage a comprehensive conduct of operations program as described in DOE Order 5480.19. Instead, the implementing procedure refers to DOE Order 5480.19 guidelines as "unique" practices for achieving discipline and rigor of operations. The policy and implementing procedure provide minimal criteria or guidance as to when the DOE Order 5480.19 information should be used.

- As an example of inappropriate conduct of operations practices, Radian (a Bechtel Jacobs subcontractor responsible for the operation of CNF), in order to minimize manpower costs, decided not to implement essential aspects of shift turnover. Radian revised their shift turnover procedure to eliminate face-to-face turnovers. In accordance with the procedure, operators at CNF are expected to assume shift duties before obtaining the condition and status of the facility and without the benefit of questioning the off-going operator. Current turnover practices include a face to face supervisor turnover and supervisor presence in the control room during operator turnover. However, these actions are not required by procedure and do not compensate for the detailed information exchange which should occur between operators in a discussion of facility conditions, evolutions, and trends. In the rigor of operations checklist for the facility, the Bechtel Jacobs project manager has determined that the requirement in DOE Order 5480.19 for discussion and exchange of responsibility is not applicable for CNF. No justification in the rigor of operations matrix is provided or required. The guidelines in DOE Order 5480.19 and the associated DOE standard on operations turnover (DOE-STD-1038-93) are clear on the intent of shift turnover. The Standard states that "A discussion of all information concerning the work station must be accomplished and the oncoming and off-going personnel must be confident that an appropriate information exchange has taken place before transferring responsibility." In an observed CNF shift turnover, the control room was manned by an operator who was not fully cognizant of facility conditions until approximately 15 minutes into the shift.

- Guidance on procedure use for DOE prime contractors and subcontractors does not meet the minimum expectations delineated in DOE Order 5480.19. For example, the Bechtel Jacobs procedure describing the development, review, approval, and use of procedures does not adequately ensure quality development and use of procedures by workers. Risk- or hazard-based criteria for determining the types of technical procedures ("general intent" or "in-hand") are not provided. Subcontractors perform most Bechtel Jacobs work, and the Bechtel Jacobs procedure does not provide an acceptable model for the subcontractors to follow in procedure development and use. The BNFL procedure on enhanced work planning provides adequate direction for development of work instructions, but provides minimal guidance on expectations regarding work instruction use in the field.

- Rigorous compliance with procedures and safety controls is needed to ensure that nuclear facilities are operated within the bounds of the approved safety basis. The Building K-25 BIO states that the operational controls in Section 6 are required to establish the safety basis. One of the specific controls referred to is "Roof Repair." This operational control states in part that, "All roof areas are included in ongoing S&M [Surveillance and Maintenance] Roof Program activities to identify roof leaks for corrective action." According to the facility manager, the S&M Roof Program was abandoned a couple of years ago in association with the contract change, and the current rate of roof repair is not reducing the total number of leaks. The BIO states that repeated freezing and thawing of snow and ice introduced because of existing roof leaks reduces the structural integrity of the building. The preponderance of roof leaks in the building raises questions on the validity of the structural analysis assumed in the BIO. Although the FMSIT subcontractor performs a similar facility level roof surveillance program at the K-25 Building, the cancellation of the S&M Roof Program required in the BIO was not analyzed for its affect on the safety basis assumptions in accordance with the USQD process.

- Numerous LO/TO deficiencies across the site involving different prime contractors and subcontractors indicate that program implementation does not meet DOE Order 5480.19 and DOE Standard 1030-96 minimum expectations. See the first issue in section 3.1 for further details.

- BNFL and DRS are also not required to follow DOE Order 5480.19. Therefore, a formal conduct of operations programs has not been established to ensure appropriate operational controls. For

example, in the K-33 building, lighting controls were obscured with torn, handwritten paper signs and warnings. Although not in accordance with acceptable conduct of operations practices as defined in DOE Order 5480.19, this improper labeling was deemed satisfactory by a senior BNFL site manager.

Conclusion

Some good conduct of operations practices were observed at ETTP. Personnel are generally aware of their ES&H responsibilities and carry out their job assignments in a professional manner. However, several prominent examples of unacceptable conduct of operations practices were observed across most of the prime contractors and subcontractors. These breakdowns in performance are the result of OR not requiring or encouraging the formality and rigor of operations necessary for nuclear and radiological facilities. Significant DOE and contractor management attention is needed to ensure these unacceptable practices do not continue.

3.3 Radiological Protection

The investigation team examined programmatic and operational radiological control activities across the three prime contractors and their subcontractors at ETTP including Bechtel Jacobs, SEC, BNFL, DRS, IT Corporation, and others. The team observed HEPA filter changeout by IT, plan-of-the-day meetings, ALARA pre-job briefings, radiological release surveys, converter and compressor disassembly, pipe removal, and size reduction in the K-33 building by BNFL and decontamination activities in K-1420 by DRS. The team also examined a range of radiation work permits (RWPs), procedures, technical basis documents, and dosimetry/bioassay records.

Bechtel Jacobs established the ETTP Radiological Control program as a site project, staffing the program with two project health physicists (PHP) and associated staffs. One PHP is assigned responsibility for Legacy Waste and Waste Operations, and the other is responsible for Bechtel Jacobs and Uranium Projects. Bechtel Jacobs subcontracted with SEC to provide radiological control program supervisory and technician services to the ETTP. BNFL has their own radiological control program that includes a Radiological Control Manager (RCM), an Assistant RCM, and 21 Radiation/Safety Technicians (RSTs). DRS, a prime contractor to DOE, is performing D&D in Building K-1420, before they lease the facility from CROET. DRS radiological control staff includes a Radiological Control Manager, Radiological Control Supervisor, and ten Radiological Control Technicians. Also, the Director of Regulatory Affairs serves as the Radation Safety Officer.

The team found that in most cases contractors and subcontractors had the appropriate level of technical staff and knowledge (either directly or through consulting agreements) to administer radiation control programs. It was also found that Bechtel Jacobs had taken specific actions to improve program performance following the Paducah and Portsmouth investigations. These actions included procedure modifications, training, technical basis document development, and clarifications to the Radiological Control Operations Guide. However, some incomplete corrective actions for identified deficiencies and programmatic weaknesses in managing and implementing radiological control continued. Furthermore, OR had not taken effective action to ensure that contractors' and subcontractors' radiological control programs were effectively implemented to minimize the risks to workers.

Issues

Issue 9. OR has not ensured that prime contractors develop, implement, and maintain radiation protection programs with sufficient rigor and formality, resulting in increased potential for unnecessary exposures to workers.

Oak Ridge Operations Office

- Despite previously identified weaknesses, OR has not conducted effective oversight of contractor radiological control activities to ensure that lessons learned from investigations at Paducah and Portsmouth were incorporated into Bechtel Jacobs' radiological control operations at ETTP. Consequently, the team identified a number of recurring deficiencies related to Bechtel Jacobs RWPs. These included RWPs that were not properly used, and did not adequately identify or analyze radiological hazards expected or encountered during work at the site.

- In October 1999, BNFL's general management requested historical information from the DOE contracting officer representative related to

processing of reactor returns and transuranic contaminants in Buildings K-29, K-31, and K-33. Although the information has not been provided to the BNFL Radiological Control Manager, OR has allowed BNFL to proceed with work with only a limited formal radioisotopic characterization of the buildings for which they have responsibility.

- In June of 1999, the DOE Laboratory Accreditation Program (DOELAP) Administrator granted an exception to OR for the BNFL dosimetry program. This exception however, required either OR or a DOELAP assessor to conduct an onsite assessment of the vendor as part of the quality assurance program for contractors. The onsite assessment was required within six months, but no later than one year, and was to be forwarded to the Administrator upon completion. Contrary to these requirements, DOE has not conducted this assessment.

- In June 1998, DRS prepared the K-1420 Characterization Sampling and Analysis Plan for ORO, under contract DE-AC05-98OR22585. The Plan stated the overall objective of providing technically representative analytical data for K-1420 decommissioning and waste disposal activities, and determining the physical, radiological and hazardous characteristics of wastes within the facility. However, the Plan's historic site assessment did not fully capture the myriad of activities conducted in K-1420 over its operating history, such as work for other DOE sites that introduced additional radioisotopes into the facility's process streams. The team determined that the Plan was developed primarily for waste acceptance, and not for the identification of potential health and safety concerns. The Plan stated that EPA-approved or other well-established methods would be used for radiological parameters. The Plan did not further discuss the established methods or industry accepted survey guidance such as the "DOE Environmental Implementation Guide for Radiological Survey Procedures," the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," or the "USNRC NUREG 5849 Manual for Conducting Radiological Surveys in Support of License Termination." The limited number of samples (23) are likely to be inadequate to characterize a facility the size of K-1420 (94,500 ft^2 floor area). Incomplete radiological characterization of the workplace adversely affects DRS's ability to identify hazards and institute controls to ensure consistent and appropriate radiological protection for workers. OR authorized DRS to proceed with D&D work, based upon data developed during the limited characterization of the building.

- On February 16, 2000, an OR health physicist conducted an operational awareness review of the DRS radiological control program at K-1420, including internal dose reports. Finding Number 1 from that review stated: "Results of bioassay analyses and reports for the DRS project have not all been received in a timely manner to adequately assess potential intakes of radioactive materials. For example, the third quarter 1999 urine sample results were not received by DRS until February 2000 (10 CFR 835.410(a))." During interviews with the team, the OR Health Physicist stated that he had been informed that the late receipt of urine bioassay data was related to DRS's nonpayment of their bioassay vendor due to budgetary shortfalls. There was no evidence that OR took action subsequent to the Operational Awareness finding to ensure the integrity of the bioassay program.

Bechtel Jacobs and Subcontractors

- Many of the RWPs in use at the site deferred descriptions of work and hazard control requirements, both mandated by the RWP procedure SH-A-4030, "Radiological Area Entry Control," to other work documents. For example, although Bechtel Jacobs PHPs recognize the RWP as the only authorized radiological work control document for ETTP, the Legacy Waste group routinely uses an additional form to augment the RWP. The form 094, WTSO-F-094, "Personal Protective Equipment (PPE) Requirements for a Waste Staging Area/Storage Unit Operation" is used to stipulate engineering controls, derived air concentration (DAC) limits, and air sampling and respiratory protection requirements, among other controls to be implemented during the work.

- Before Bechtel Jacobs waste processing activities are performed, legacy waste operations subcontractor (WESKEM) personnel develop JHAs that are derived from waste-stream-specific requests for disposal. The radiological control

organization uses the JHA to develop the RWP, as well as the associated Form 094. However, the input to the JHA generally identifies, but does not quantify the radionuclides present, making hazard determination and implementation of controls potentially less reliable.

- Although many Form 094s stipulated transuranic radiological controls, those controls are not always the most conservative. For example, many Form 094s mandated airborne radioactive material limits for neptunium-237, but failed to quantitatively consider the more restrictive airborne radioactive material concentration for thorium-232 that was also present in the waste stream. The Form 094s also indicated that tritium was also a common radionuclide encountered during legacy waste operations. Although PHPs believed that the estimated quantity of tritium contained in some waste streams would not pose a threat to legacy waste workers, verification by air sampling is not conducted to determine the levels of airborne tritium in the workplace.

- Since RWPs and Form 094s are used to identify radiological hazards associated with specific work evolutions, Bechtel Jacobs is establishing radiological controls based upon incomplete or inadequate radiological data. In addition to circumventing the RWP controls required by procedure SH-A-4030, "Radiological Area Entry Control," Revision 4, current Bechtel Jacobs practice often results in the association of multiple Form 094s with a single RWP. Consequently, personnel could be exposed to a variety of radiological conditions under the same RWP.

- Both Bechtel Jacobs and BNFL use electronic RWP sign-in systems that do not validate worker qualifications or readiness to perform work under general or specific RWPs. Some Bechtel Jacobs employees have signed onto expired RWPs, and individuals at both Bechtel Jacobs and BNFL have signed onto RWPs without proper qualifications. In addition, the Bechtel Jacobs process for developing and approving RWPs for back shifts is not defined in the procedure.

- Bechtel Jacobs procedure SH-B-4018, "Design and Control," requires radiological control to conduct formal evaluations of proposed facility designs and significant modification of existing processes and facilities (including major maintenance, decontamination and decommissioning, and environmental restoration). The radiological engineer for ETTP projects indicated that the procedure had been reviewed and determined to be not applicable to their operations. Following interviews with the investigation team, the radiological engineer later determined that the procedural requirements would apply to a number of activities planned or ongoing at the site and subsequently developed project files for those activities. The PHP and radiological engineers for Legacy Waste and Waste Operations indicated that two design and control reviews had been conducted. One package required a smoke test following construction of a cool room in the waste repackaging area of K-1423. The Project Engineering and Industrial Hygiene logbooks indicated that the test had been completed; however, the design and control package did not contain documentation related to the test.

- Radiological controls by Bechtel Jacobs subcontractors do not adequately limit the potential spread of contamination and maintain exposures ALARA, and not all requirements resulting from ALARA reviews of proposed work are incorporated into RWPs. For example, personnel survey requirements in an ALARA review were never captured in the subsequent RWP and were not performed during the work activity. Additionally, Bechtel Jacobs bioassay program results indicate that before Bechtel Jacobs' implementation of the Waste Treatment and Storage Operations bioassay program in September 1999, personnel were generally sampled only for uranium isotopes, and limited sampling was completed for the other isotopes to which they were potentially exposed (e.g., transuranics, thorium isotopes, technetium, and tritium).

- There is no formal internal Bechtel Jacobs radiological control program to capture, report, track, or document closure of self-identified radiological control-related deficiencies in work processes, procedures, or operations. For example, no process exists for capturing program-related

deficiencies identified during radiological control walkdowns of work areas and control measures, personnel contamination cases related to poor radiological control work practices, radiological area entries on expired RWPs, or equipment operability issues affecting worker radiological safety.

Building K-31 Facing Northwest

BNFL, Inc.

- Assessments of BNFL's radiological control performance by OR and BNFL have repeatedly identified deficiencies in maintaining contamination areas (CA) and high contamination areas (HCAs), including the failure to control area boundaries. Corrective action and reoccurrence controls to address the deficiencies were either inadequate or ineffective. The team also identified that several HCAs had poor demarcation and in numerous instances, equipment inside the boundary extended underneath the rope and into the aisles. CA and HCA boundary ropes were lying on the floor, and in some cases the boundary rope was tied to contaminated equipment. In addition, several torn bags of radiologically contaminated materials were lying in walkways within the CA; they appeared to have been run over by mobile equipment. Although boundary control deficiencies were identified during previous OR and internal audits of BNFL activities, personnel, forklifts and other vehicular traffic continue to move between CAs and HCAs without surveys. For example, the team observed a forklift operator step off his equipment inside the HCA, get back on the forklift, and exit the area without the required whole body survey.

- The basis for BNFL's radiological air sampling and bioassay programs is the assumption that only Class D uranium (highly soluble) is present. The effects of plasma arc cutting and other D&D activities on particle size distribution and solubility class have not been determined, although recent actions have been taken to gain insight into these issues. Incomplete radiological characterization of the workplace adversely affects the ability of the BNFL radiation safety organizations to identify hazards and institute controls to ensure consistent and appropriate protection for workers.

- The BNFL radiation protection program was approved using 1996 and 1997 K-25 technical basis documents to support air sampling, bioassay, and routine surveys. These documents may not accurately reflect current conditions in K-29, K-31, and K-33 and may not be representative of all of the current work being carried out under the BNFL contract. These documents predate much of the current information on transuranic and fission product materials fed into or potentially present in the enrichment cascades.

Decon Recovery Services

- During review of the DRS air sampling program, the investigation team requested the air sampling technical basis used by the contractor. The team was provided a copy of a 1997 LMES technical basis document. DRS maintains that an air sampling technical basis document is not required to be developed or maintained, and that the 1997 LMES air sampling technical basis document is periodically referenced for guidance. OR authorized DRS to proceed with D&D activities in K-1420, without an approved technical basis document for their air sampling program. The team also identified deficiencies in air sampling performance. For example, stationary air samplers were located in at least one area of the building to monitor airborne radioactive material concentrations at radiological boundaries. However, airflow studies were not conducted to verify placement of the equipment, nor had DRS

assessed the impacts of equipment movement and storage on airflow patterns in K-1420 and its effect on the quality of sample data collected as part of the air-sampling program. Correspondence received from DRS after the onsite inspection stated that DRS did not use stationary air samplers, nor had DRS developed or maintained a technical basis for air sampling, relying only upon "standard, industry-accepted practices." However, DRS did not provide references for the standard practices relied upon to accomplish their radiological air-sampling program.

Issue 10. DRS did not take appropriate and aggressive actions to evaluate or reconcile potential personnel exposures to transuranic isotopes during D&D work at Building K-1420, resulting in potential unevaluated exposures to workers.

- During the second quarter 1999, contractual issues resulted in a delay in DRS receiving bioassay results for the third quarter of 1999. Additionally, vendor-related software problems resulted in a delay in DRS receipt of fourth quarter 1999 bioassay data. While the contractual issue was subsequently resolved, most of the fourth quarter 1999 bioassay data had not been received from the vendor during the period of this investigation (June 2000).

- DRS' procedures for internal dosimetry and bioassay assessments require isotopic urinalysis as the primary bioassay method for all routine samples. However, the bioassay program currently implemented at DRS only monitors for uranium and technetium-99. In addition, the procedures do not capture and implement the dose-based special bioassay requirements contained in the "K-1420 D&D Project Technical Reference for Internal Dosimetry," Revision 0, December 1998, Section 5, "Special Bioassay Protocols."

- Although procedures required the Radiological Control Manager to provide initial dose estimates, and to take actions concurrent with that evaluation, no evidence was available to demonstrate that procedural requirements were implemented following the identification of positive urinalysis results for transuranics and technetium-99. The contractor's current contention that transuranic results are invalid when uranium is not present in the bioassay sample is not consistent with procedural requirements. Furthermore, the contractor's contention that transuranic results are invalid is based upon data from a limited number of characterization samples collected in the facility (see Issue 10).

- Although DRS maintains that annual dose to DRS personnel has been tracked and is below threshold limits, bioassay (urinalysis) results for DRS operations in K-1420 indicated potential internal transuranic exposures for two personnel in 1998 and six personnel in 1999. The DRS radiological control supervisor noted that the 1998 transuranic bioassay data were suspect, contributing to disqualification of the vendor. Although DRS maintains the referenced bioassay results indicated false positives for transuranics based upon assumed uranium to transuranic ratios, there is no evidence of formal documentation of exposure investigations maintained by DRS to support disqualification of the vendor-supplied data, or to resolve the potential personnel exposures. Further, there were no records to indicate that personnel had been restricted from work in radiological areas pending outcome of the exposure investigations. Although the new bioassay vendor reported positive transuranic urinalysis results to DRS for six personnel in October 1999, DRS did not maintain records to indicate that the bioassay results were investigated as possible intakes as required by their internal dosimetry procedures and technical basis document. In five of the cases, special bioassay sampling consistent with company requirements was not conducted, and follow-up samples were not collected until the next regular quarterly sampling evolution. For example, a bioassay sample submitted on October 1, 1999, indicated positive bioassay results for americium-241 and neptunium-237. A follow-up sample, submitted on October 26, 1999, revealed a continuing positive result for neptunium-237, with americium-241 reported as non-detectable. Although one positive americium-241 result and two positive neptunium-237 results were reported for the employee, DRS did not undertake actions required by their procedures and internal dosimetry technical basis document for responding to positive transuranic bioassay results. In fact, the company failed to request that their bioassay vendor perform analysis for transuranic radionuclides during the next quarterly sampling evolution in March 2000,

instead requesting analysis only for technetium-99 and isotopic uranium. Consequently, this potential exposure remained unresolved at the time of the investigation.

Conclusion

Although many day-to-day radiological control activities are conducted safely, neither Bechtel Jacobs nor OR has taken effective action to ensure that corrective actions for previously identified gaseous diffusion plant radiological control deficiencies were undertaken and completed to address programmatic and implementation weaknesses at ETTP. Consequently, many of the same deficiencies observed at Paducah and Portsmouth were identified at ETTP. OR's lack of action resulted in a failure to ensure that rigorous radiological control programs were implemented by prime contractors, that radiological control processes and measures were adequate and effectively implemented to minimize the risks to workers, that contractors developed and implemented adequate technical bases for their operations, and that radiological safety was not compromised by cost and schedule pressures. DRS did not ensure that cognizant personnel complied with the requirements of their internal dosimetry technical basis document and procedures for initial intake/dose estimates, bioassay resampling, and restriction of personnel with positive indications of intakes of transuranic materials. Timely actions were not undertaken to resolve possible personnel internal exposures to transuranic radionuclides during D&D work in the K-1420 building.

3.4 Occupational Safety and Health

Due to the large population of prime contractors, direct subcontractors, and lower-tier subcontractors and their interrelationships, occupational safety and health programs at ETTP are numerous and complex. Each of the four DOE prime contractors – Bechtel Jacobs, BNFL, DRS, and M&EC – has an occupational safety and health program at ETTP, as do their subcontractors. For Bechtel Jacobs, the contract with DOE has resulted in the proliferation of subcontractors, with over 30 Bechtel Jacobs subcontractors each administering an occupational safety and health program of varying completeness. Furthermore, since there are four distinct Bechtel Jacobs programs operating within the ETTP site (waste operations, waste disposition, uranium programs, and ETTP projects), each of these programs has a project-specific Bechtel Jacobs ES&H staff to provide oversight of subcontractors. In addition, ETTP has over 20 privatized companies (tenants) that implement their own occupational safety and health programs, under the guidance of DOE ES&H. The dominant safety and health challenge for OR at ETTP is oversight of this community of contractors and subcontractors, and support to the DOE reindustrialization office at ETTP. This same challenge extends to Bechtel Jacobs, as the management and integrating contractor at ETTP.

For occupational safety and health programs, the diversity and breadth of occupational safety and health resources and experience at ETTP presents an opportunity for enhanced focus on common safety and health problems and the development of innovative improvements in risk mitigation. Each company at ETTP brings unique safety and health talent and experience. For example, there is a greater wealth of ideas and examples at ETTP on preparing HASPs, or on performing JHAs, than at most other sites within the DOE complex. There are also a large number of experienced safety and health professionals with both DOE and commercial experience. Examples of several positive safety and health programs or activities are:

- BNFL has revised its Site Health and Safety Plan to address expectations for documenting industrial hygiene surveys and other requirements that will improve the quality and consistency of safety records.

- Bechtel Jacobs has implemented a computer-based worker exposure-tracking system (Industrial Hygiene Analytical System) that will track and record a worker's exposure history to non-radiological hazards (e.g., noise, chemicals, and heat).

- DRS implemented a safety rewards and discipline program that has improved worker morale while clearly communicating and enforcing a policy of safe work. Worker safety input is actively solicited by DRS management, documented during monthly safety meetings, tracked, and typically resolved.

- IT Corporation, a Bechtel Jacobs subcontractor, has assigned the waste disposition program manager concurrent responsibilities as facility manager and building operator, to clarify lines of responsibility and authority with respect to building safety and health issues.

Conversely, processes have not been established by DOE at the ETTP site level to channel these safety and health resources so that all ETTP contractors and subcontractors work together effectively. Consequently, opportunities for improved performance are missed. In a number of cases, if two contractors are performing similar work, with the same hazards, inconsistent JHAs are not reconciled prior to performing work (e.g., JA Jones and Bechtel Jacobs for cylinder yard work). On occasion, work is impeded since the work priority of one contractor is in conflict with another contractor (e.g., MDM and WESKEM on drum sampling). On other occasions, safety and health professionals of different contractors are unaware of or fail to implement worker exposure limits consistent with contract requirements and DOE expectations (e.g., DRS, Sharp and Associates, and IT Corp). Furthermore, there is a wide disparity in the qualification of safety professionals and technicians among contractors, since there are no common standards or guidelines for qualification for these positions, and no designated model of excellence.

The site's ineffective effort to implement an occupational medical program consistent with DOE expectations and requirements is an example of how fragmented a multiple-contractor system can be. The DOE decision to transition to multiple, prime contractors not under the management and integrating contractor has effected many changes in the way ETTP workers access and obtain occupational health services. The results of these modifications allow ETTP prime contractors to independently negotiate individual Work Smart standards, creating a variety of medical program requirements for similar work activities. In addition, contract provisions have allowed companies to procure their occupational health services from vendors of their choosing without considering the requirement for DOE to access and retain employee medical information for exposure, legal, and research purposes. The ability of OR safety and health officials to assure minimum standards of care, assign responsibilities for medical program development, ensure the collection and preservation of medical information, and maintain the integration of medical resources into work planning and control process is decidedly diminished. Similarly, performance assessment and feedback mechanisms, already difficult to achieve with existing site-specific occupational medical programs, will be even more problematic with offsite vendors.

Issues

Issue 11. The identification, understanding, and implementation of some contract requirements for safety and health by Bechtel Jacobs and its subcontractors and DRS are not adequate to ensure the protection of the workers.

- Bechtel Jacobs subcontractors have not adequately implemented some elements of Exhibit G (Environment, Safety and Health) of their contracts. For example, WESKEM, IT Corporation, and MDM do not perform personal sampling to assess non-radiological exposures to the extent required by Section 4.7.3 of Exhibit G. Non-radiological exposure data for individual workers is not readily retrievable at the site level, since some subcontractors are not submitting their exposure data to Bechtel Jacobs as required by Exhibit G. Additionally, Exhibit G requires that carcinogens (greater than 0.1percentage) be evaluated for substitution with alternate chemicals. Suspect carcinogens of unknown concentrations were identified in paint being used by IT Corporation/JA Jones at the TSCA incinerator, but the required evaluation had not been performed by IT Corporation. Further, a number of activity-level hazards assessments do not address each step of the work activity, nor are the JHAs submitted to the Bechtel Jacobs subcontractor technical representative as required by Exhibit G of their contract (e.g., ATI/FMSIT).

- DRS and Bechtel Jacobs subcontractor industrial hygiene and industrial safety staff lack familiarity with some of the ES&H requirements in their contract, especially those requirements that are unique to DOE facilities. For example, several subcontractors, and one DOE prime contractor (DRS), were not aware that threshold limit values (TLVs), as established by the American Conference of Governmental Industrial Hygienists (ACGIH), were requirements within their contract. DRS is incorrectly applying OSHA permissible exposure limits (PELs) to prescribe personal protective equipment (PPE) for noise and respiratory protection rather than required TLVs that are more restrictive. OSHA hearing protection requirements are based on a 90 dBA limit with a 5

dBA exchange rate, whereas ACGIH requirements are 85 dBA with a 3 dBA exchange rate. For noise, this approach has resulted in specifying hearing protection that may not be adequate for meeting the noise TLV requirement.

- Some changes in external ES&H requirements (e.g., ACGIH, ANSI) have not been implemented or documented. For example, neither Bechtel Jacobs nor its subcontractors have implemented the 1998 changes to the ANSI standard for emergency eyewash and shower stations (ANSI Z358.1). Observed stations were not in compliance with recent changes in maintenance and testing requirements.

- Some subcontractor HASPs or procedures are not sufficiently comprehensive to address all applicable requirements or hazards. For example, two of the three recordable injuries incurred by JA Jones employees during the past year have been ergonomically related yet JA Jones does not have an ergonomics program. Bechtel Jacobs has implemented an ergonomics program that has effectively reduced ergonomic-related injuries, but has not imposed similar requirements on Bechtel Jacobs subcontractors, such as JA Jones. Since April 1998, DRS has also incurred two recordable injuries, both of which were ergonomically related. DRS does not have an ergonomics procedure or program to implement the ergonomic requirements of DOE Order 440.1A, as required by the work smart standards. Entech Corporation lacks adequate procedures for medical monitoring, temperature extremes, ergonomics, and bloodborne pathogens.

- For some work activities, the ES&H requirements are not clearly identified. For example, at the TSCA incinerator, neither the ES&H staff nor project management could concur on the requirements for hazardous waste operations (HAZWOPER) training for visitors, or the definition of a "restricted area." As a result, facility access, work activity controls, and facility access training requirements are unclear and subject to misinterpretation.

Issue 12. Activity and building hazard analyses and processes performed by BNFL, Bechtel Jacobs, and their subcontractors lack adequate and/or timely identification, documentation, and communication of some hazards, which have contributed to an instance of worker overexposure to a physical health hazard.

- Several Bechtel Jacobs subcontractors (e.g. Entech, MDM) do not have a hazard analysis procedure or instruction that explains and controls the JHAs which they routinely prepare. With respect to MDM, Bechtel Jacobs had identified this deficiency in March 2000, and MDM has submitted a corrective action plan.

- Some activity level hazard analyses failed to adequately identify or analyze the hazard. For example, at K-33 BNFL had not been evaluated a high noise hazard that has been in existence since the BNFL D&D Workshop was established (November 1999). In the D&D Workshop, the impact noise hazard of dumping recirculating cooling water system pipe into intermodal boxes was identified in work documents (i.e., the Enhanced Work Plan), however, some workers were not wearing hearing protection as required in the Enhanced Work Plan. Noise levels in this area, measured prior to and after the EH Team's observation, were above regulatory limits. There was no change in the work activity during this period. An occurrence report has been issued. Also at K-33, the BNFL industrial hygienist had not properly measured or evaluated other impact noise sources that may exceed the impact noise TLV (e.g., converter and compressor disassembly). In another example, although an activity level JHA was prepared by ATI/FMSIT for the Filter Test Facility, it did not assess the hazards or establish the controls for the handling of dioctyl phthalate (DOP). Safety requirements for handling DOP are contained in the procedure for measuring its usage, but are not repeated or referenced in all procedures that require DOP handling (e.g., ATI-FTF-460, Rev. 0).

- A number of JHAs were inaccurate, not adequately completed, or resulted in confusion among workers. At a painting job at the TSCA incinerator, some hazards and controls were missing from the JHA or were not implemented, and seven JHAs were required to perform a four-step work activity. At BNFL, controls stated in an Enhanced Work Plan for a noise hazard associated with a pipe machine

operation were not specific (i.e., "hearing protection should be offered to personnel and visitors entering the area"). See Section 3.1 for additional examples.

- Several building emergency plans and authorization basis documents are out of date and do not accurately reflect either the hazards or the material stored in the building or activities. For example, both the K-1004D auditable safety analysis (ASA) and the K-1037 ASA have not been revised since 1995. Although some recent hazard analyses have been performed, the ASAs, the ASAs do not accurately reflect current activities or hazards within the buildings. In addition, the building emergency plans indicate that no toxic materials are stored in either building, yet the investigation team observed hazardous chemicals and toxic metals in these buildings.

- Some hazards are not adequately communicated. For example, not all facility managers and building operators are well informed of the hazards created by the activities of building occupants, and particularly of changes in the their operations that may present new hazards to building occupants. Facility managers do not routinely inform tenants of hazards introduced by new occupants. In another example, work area specific chemical hazard training is not being conducted or documented by Bechtel Jacobs subcontractors as required by 29 CFR 1910.1200 and Bechtel Jacobs procedures.

- BNFL safety and health personnel are not sufficiently involved in analyzing hazards at the design stage for new projects. For example, safety and health personnel have not been involved in the Super Compactor design or installation due to be completed this fall. This deficiency was previously identified by OR in December 1999, but no action has been taken. In another example, industrial hygiene was involved in the review of ventilation systems designs at the K-33 building; however, line management failed to implement the industrial hygiene recommendations, resulting in inadequate ventilation design.

Issue 13. Activity-level hazard controls for some activities, although documented in work packages and hazard analyses, are not effectively implemented by BNFL, DRS, Bechtel Jacobs, or their subcontractors, resulting in some requirements not being met or engineering controls not being effectively implemented.

- Both the activity hazard analysis and the Entech HASP for the K-25 waste encapsulation project require illumination of at least 5 foot-candles to perform work. Measurements requested by the team showed that illumination levels were only 1 to 2 foot-candles. No measurements had been performed to ensure that the control was implemented.

- The WESKEM work package for replacement of O-rings on waste containers requires continuous industrial hygiene monitoring of workers during drum opening. However, no industrial hygiene support was present during the team's observation of drum openings in Building K-1065D.

- DRS researchers and technicians were working on robotic equipment for remote D&D operations without hearing protection, although the area (east side of K-1420) was a noise area that required hearing protection.

- On several occasions, inadequate ventilation controls at the BNFL K-33 Project have been identified and documented, but the engineering controls have yet to be modified to correct the deficiencies. For example, none of the following documented deficiencies have been corrected. A November 12, 1999, assessment by a subcontractor certified industrial hygienist identified an inadequate HEPA ventilation system, which has not been corrected. A readiness review conducted in August 1999 by the OR industrial hygienist determined that the ventilation design in the D&D Workshop area was inadequate. During April 2000, a ventilation consultant confirmed the poor design of installed ventilation for two pipe-cutting machines in the D&D Workshop. In addition, the BNFL industrial hygienist documented (April 12, 2000) that the fume capture velocity at the Freon condenser shell plasma arc cutting station was not adequate to reduce the airborne concentration of iron oxide below the TLV. The aforementioned examples, although not indicative of a lack of engineering controls, did not result in overexposures, since workers were wearing respirators.

- Personal protective clothing for some work activities was more than that required by the hazard, or there was a lack of emphasis on reduction of PPE through engineering controls. For example, at the K-33 building (BNFL), the lack of improvement in ventilation controls in the D&D Workshop and at the Freon condenser shell cutting station has required the use of respirators, since the fume concentrations without the ventilation controls are above the TLVs. Unnecessary use of PPE can adversely impact job performance and other safety elements.

- In some cases, controls that are specified on one form on a work package conflict with controls specified on other forms. For example, in a number of cases, for waste disposition projects, radiological control requirements that are stipulated on a Form 094, "PPE Requirements for a Waste Area/Storage Unit Operation," are in conflict with the controls identified on the RWP (see Section 3.3 for details).

Issue 14. Bechtel Jacobs, WESKEM, and ATI facility managers and building operators do not have or exercise sufficient control over building occupants, tenants, and activities to ensure that hazards are identified, evaluated, mitigated, and/or controlled.

- While roles and responsibilities for facility managers and some building operators are defined (e.g., ATI), this is not the case for other contractors serving as building operators. Roles and responsibilities, even when defined, are not adequately communicated. For example, some ATI building operators (e.g., K-1004D and K-1037) were unaware of the ATI management plan that documents their roles and responsibilities. The WESKEM building operator was unfamiliar with the Bechtel Jacobs facility management procedure that defined building operator roles and responsibilities.

- The WESKEM building operator for the K-1065 Building was not cognizant of the building authorization basis and felt he had no control or jurisdiction over chemicals used or stored by other building tenants (e.g., MDM). Nearly 100 containers of legacy composite samples had accumulated in Building K-1065D for which there was no owner.

- Numerous facility level safety deficiencies were identified in Building K-1004D. The Bechtel Jacobs/ATI facility management team either was not aware of these deficiencies, or had not initiated corrective actions. Examples included inactive eyewash stations, ventilation hoods not tagged out, poor housekeeping, electrical box and cord deficiencies, storage of legacy chemicals with no owner, and inadequate emergency lighting.

- Although not as extensive, similar building-related safety deficiencies were also identified in Building K-1037. In addition, in May 2000, a DOE tenant installed a 9,000-gallon hydrogen storage tank outside of K-1037 that had not been evaluated against the safety authorization basis. An occurrence reported resulted.

- A training program does not exist for some WESKEM building operators. In other cases, the only training is on-the-job training. For subcontractors with training programs (e.g., ATI), the training does not address roles and responsibilities of building operators as defined in ATI procedures. These training deficiencies have hindered the resolution of safety deficiencies in some buildings.

Issue 15. OR has not ensured that all ETTP contractors and their subcontractors meet the requirements of DOE Order 440.1A, *Worker Protection Management,* Chapter 19, Occupational Medicine Programs (or equivalent), which establishes a comprehensive medical program that is necessary to protect workers and promote a healthy work environment.

- Fundamental DOE medical program requirements that assign responsibility for the medical director to be knowledgeable of site hazards and activities, participate in worker protection team activities, coordinate access to employee exposure and JTA information, and control medical records have either not been included in ETTP Work Smart standard sets or have not been sufficiently managed to assure that they are successfully accomplished. These requirements, which constitute an effective occupational medical program, are unique to DOE and are not addressed in comparable OSHA regulations or other industry standards. Some contractors on their own initiative have recently

incorporated DOE 440.1A, *Occupational Medical Requirements*, (e.g., Bechtel Jacobs, DRS); however, no formal programs are in place.

- DOE allows BNFL, by contract, to solely use OSHA and other pertinent Federal regulations to guide their occupational medical program activities. Work Smart standards sets approved by OR do not include DOE Order 440.1A, Chapter 19, Occupational Medical Programs, requirements for occupational medicine. These requirements stipulate specific responsibilities and require specific actions by the medical director, safety and health professionals, and line management.

- Contractor and subcontractor safety and health plans, policies and procedures, and contract provisions do not adequately address occupational medicine requirements as outlined in DOE Order 440.1A, Chapter 19, Occupational Medical Programs. DRS, which has adopted the Chapter 19 requirements, does not have procedures or protocols that adequately describe how occupational health/medical surveillance programs are to be accomplished. DRS have a corrective action plan to address this concern.

- The use of offsite occupational medical service providers by Bechtel Jacobs subcontractors and DOE prime contractors has effectively disengaged the site occupational medical director as the person responsible for the occupational health of workers at ETTP. Furthermore, the ownership of medical records and contract provisions to assure DOE access to those records has not been clearly delineated.

- Hazard and worker exposure information is not readily available or coordinated between the numerous contractors, subcontractors, and their individual medical service providers. The responsibility for capturing or trending potential health effects from ongoing projects and activities at ETTP has not been established.

- Performance assessment and feedback mechanisms to assure the effectiveness of occupational health/medical surveillance programs at ETTP have not been formalized at the DOE, contractor, or subcontractor levels.

Conclusion

Occupational safety and health programs at ETTP are complex due to the large number of contractors and subcontractors, and their interrelationships. Individually, each contractor has certain safety and health policies, programs, and/or experienced personnel that excel within the ETTP community. However, there is no effective mechanism to integrate positive and negative shared information so that all contractors and subcontractors at ETTP may benefit from this information. The ETTP community is fragmented, and safety and health practices are often inconsistent with requirements and need improvement. Issues of most concern are safety and health requirements management, activity and building hazard analyses, implementation of hazard controls, facility management roles and responsibilities, and the occupational health programs.

During this investigation, ETTP workers raised concerns about the safety of drinking water supplies at the site due to the potential for cross-connection of drinking water supplies with other water systems. The investigation team evaluated available information about the safety of drinking water supplies during past Plant operations. The conclusions of this review are presented in Volume 1, Section 4.5. Additionally, OR commissioned a sampling and analysis study of the drinking water, fire water, and raw water at ETTP. The study team included representatives from OR; the Tennessee Department of Environment and Conservation; the Local Oversight Committee – Citizens Advisory Panel; CROET; the Paper, Allied-Industrial, and Chemical Employees Union; and Bechtel Jacobs. The results of this study indicated that there are no levels of contaminants in the drinking water that exceed published Environmental Protection Agency and State regulated levels. Also, because of suspected historical cases of cross-connections between the drinking water and other water systems at the site, a review/walkdown of the current system is ongoing. The Department will make a detailed report available upon conclusion of these efforts.

4.0 Line Management and Oversight

Line management oversight and contractor self-assessments are essential mechanisms for ensuring that contractors adequately implement safety management requirements. Line oversight and self-assessment activities provide critical information to OR and its contractors for the control of work activities and the management of facilities. Accurate and timely information is essential to ensure that workers, the public, and the environment are protected from the hazards associated with site activities. Effective oversight, including the decision to suspend or stop work, also provides a deterrent against unsafe work before injuries occur. The knowledge that deficiencies may be revealed through oversight activities provides an incentive to self-identify and correct safety problems before being required to stop work and implement more costly evaluation and corrective actions. This incentive is particularly important at ETTP, where many contractors perform work under fixed-price contracts with limited direct incentives for safe work performance.

The investigation team examined the effectiveness of DOE and contractor management systems that are necessary to protect workers, the public, and the environment. In particular, the assessment of line management and oversight focused on the adequacy of OR line oversight programs, prime contractor line oversight and self-assessment activities conducted by BNFL and Bechtel Jacobs, and self-assessment activities conducted by Bechtel Jacobs subcontractors JA Jones and WESKEM. In addition, the functional area observations and issues developed by the investigation team in the environmental protection and worker safety and health areas were included in the development of the issues and conclusions presented in this section.

4.1 Department of Energy

The DOE organizational structure provides the lines of authority necessary for management and oversight of contracted ES&H activities at ETTP. Management of ES&H for DOE work at ETTP flows from the DOE Environmental Management and Nuclear Energy program offices through OR and the Assistant Managers for Environmental Management (AMEM), Uranium and Engineering Services (AMUS), and Assets Utilization (AMAU) to a number of prime contractors and subcontractors. DOE manages contractor activities through a contracting officer and contracting officer representatives (CORs) for each prime contractor. OR provides day-to-day oversight of contractor activities at ETTP through several mechanisms. These include (1) the ETTP Site Office, which is primarily responsible for oversight of site remediation and infrastructure activities; (2) AMEM Facility Representatives, who provide matrixed support to the three OR Assistant Managers; and (3) ES&H subject matter experts matrixed from the OR Assistant Manager for Environment, Safety, Health and Quality (ESH&Q) who reside at the ETTP Site Office and at OR.

Consistent with the DOE policy for ISM, line management responsibility for safety has been appropriately assigned to the OR CORs. Most DOE line managers at ETTP accept responsibility for safety and understand the value of effective contractor oversight. In particular, the COR for BNFL is actively involved in health and safety oversight, providing direction and coordination for the operational awareness activities of Facility Representatives and subject matter experts. The Facility Representatives assigned to oversee BNFL activities provide valuable feedback to line management on contractor performance, and identify substantive performance issues resulting in COR letters directing contractor corrective actions.

Changes in contract management have accelerated progress in cleaning up the ETTP site. Little cleanup progress was achieved from 1985, when enrichment activities were terminated, until the late 1990s. The management and integrating (M&I) contract established with Bechtel Jacobs in 1998 and the financial incentives based on performance associated with this contract, have contributed to the subsequent completion of

important actions. Notable progress has been made in D&D, with D&D completed for five of the highest-risk buildings identified during the 1997 Oversight management assessment.

Although recent progress has been made, the site has not yet been characterized to the satisfaction of the EPA. Remediation progress needs to continue to accelerate, and much remains to be done to address legacy conditions. DOE has not yet resolved EPA comments on the ETTP RI that were received over a year ago, and site remedial action decisions have been delayed by the failure to resolve these comments. Sources of contamination have not been identified for some known locations of groundwater contamination. Few sources of environmental contamination have been remediated, and the majority of remediation activities are not expected to commence until after 2004. Cylinders of UF_6 in storage at ETTP represent a potential source of environmental contamination, and maintenance and storage of these cylinders have not received adequate management priority or attention.

During the mid-1980s, ETTP's mission changed from uranium enrichment to environmental restoration, waste management, and re-industrialization. Coupled with the transition to a management and integrating contract in 1998, this change has presented challenges to line management and oversight functions. In March 1998, shortly after transition to a management and integration contractor, OR revised the ES&H oversight program requirements in OR Order 220 to significantly reduce the scope of oversight of ETTP contractors. The focus of oversight was shifted from day-to-day monitoring and compliance assessments to analysis of performance measures data. Routine assessments of ES&H programs were discontinued as part of implementing this order. Assessments were permitted only when performance could not be determined from objective performance measures, and when assessments were performed for cause, joint OR/contractor participation was encouraged. Following completion of the Oversight investigation at the Paducah Gaseous Diffusion Plant in the fall of 1999, the DOE Headquarters Office of Environmental Management (EM) and OR began strengthening oversight and operational awareness of contractor work activities and addressing issues raised from the Oversight investigation. In December 1999, OR issued OR Order 450.5 *Environment, Safety, and Health Oversight Program*, which redefined the elements of the OR line oversight program for ES&H. OR Assistant Managers and OR CORs are in various stages of reviewing and revising oversight policies, procedures, and processes to meet the intent of the new OR order. In January 2000, the OR AMEM met with OR project and program managers to discuss and clarify their roles and responsibilities within the OR organization as it relates to oversight and the recently issued OR order.

In February 2000, the DOE contract with Bechtel Jacobs was revised to include provisions for a small management evaluation fee for selected performance areas, including ES&H. During this investigation, OR, in coordination with Bechtel Jacobs, was developing a process and procedures to implement the new contract provisions. In March 2000, the Assistant Secretary for Environmental Management issued a management guide to encourage managers to perform work-area walkthroughs for review of safety and health practices. The OR Manager has recently issued a similar guide, and senior EM Headquarters managers and the OR Manager have reinforced expectations for line managers and staff by personally conducting facility walkthroughs. OR recently filled the ETTP Site Office Manager position with an individual who has prior ETTP operations experience and assigned two additional Facility Representatives to monitor activities at ETTP. The ETTP Site Office has also established procedures for performing ES&H oversight, including an updated oversight plan and schedule for the conduct of walkthrough surveillances performed by matrixed ESH&Q subject matter experts. Subject matter experts assigned to the ETTP Site Office have identified and caused correction of many safety deficiencies. In December 1999, the Site Office Manager initiated a review of the

Building K-1401 (Maintenance) Facing Southwest

Bechtel Jacobs Subcontractor Technical Representative (STR) and Safety Advocate (SA) programs to determine the effectiveness of Bechtel Jacobs oversight activities; that review identified concerns similar to those found by this investigation.

In general, OR and the ETTP Site Office have systems in place to ensure that personnel responsible for providing oversight of contractor activities have received training in fundamental safety areas relevant to operations at ETTP. OR has prepared a draft program manual to address the requisite qualifications and competencies of Facility Representatives, although it has not been formalized in terms of specific implementing procedures and performance expectations. However, this investigation identified deficiencies in the training and qualification of DOE personnel responsible for oversight activities.

The programs necessary to achieve effective management control and consistent application of DOE initiatives are not fully developed or rigorously applied, and the initiatives taken have not yet produced an adequate level of compliance with safety requirements. Progress in development and implementation of key elements of OR Order 450 has been hampered by key OR managerial and team leader positions not being filled for extended lengths of time. Compliance problems identified by this investigation, and deficiencies identified by OR operational awareness reviews, indicate the need for more effective line oversight. Compliance problems were particularly evident in waste management activities performed by a Bechtel Jacobs subcontractor, WESKEM, and in the decontamination of Building K-1420 by DRS, where OR line management had not developed and implemented comprehensive oversight plans. In addition, oversight strategies were not sufficiently focused on ensuring the adequacy and effectiveness of prime contractor self-assessment processes or the implementation of contractual requirements by its subcontractors. DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, which describes key elements to be included in oversight and self-assessment programs, has not been fully implemented at ETTP.

4.2 Prime Contractors and Principal Subcontractors

Four major prime contractors—BNFL, Bechtel Jacobs, DRS, and Materials and Energy Corporation (M&EC)—manage ES&H programs and performance through various organizations and mechanisms. In addition, reindustrialization of ETTP facilities and equipment is facilitated through a leasing agent, CROET, which has subcontracts and agreements for most site infrastructure work, including grounds and outside utilities maintenance and operation of the steam, sanitary water, and sewer plants. Bechtel Jacobs and DRS have developed and are implementing an integrated safety management system (ISMS) program that was subjected to a DOE Phase I and II verification process (program adequacy and implementation) in January 2000 and April 2000, respectively. Due to the significant number of weaknesses found by the DOE verification team in Bechtel Jacobs implementation of ISMS core functions and guiding principles, and findings identified by the Office of Oversight independent investigation team at Paducah and Portsmouth, the OR Manager directed Bechtel Jacobs to take prompt action to address all ISMS related weaknesses from the DOE verification and investigation reviews, and committed to an independent review to verify effectiveness of corrective actions prior to September 30, 2000. In addition, the OR Manager had not approved the DRS ISMS system description at the time of the onsite investigation. DOE Phase I and II ISMS verification reviews are also scheduled for the Three Building D&D and Recycle project performed by BNFL and M&EC in July and August 2000, respectively. While the primarily results from the Phase I ISMS verification of BNFL's program were deemed adequate to proceed with Phase II ISMS verification, the team leader suspended the review when significant weaknesses were identified in ISMS implementation, including work planning and control, and effectiveness of corrective actions, recurrence controls, and lessons learned from prior events and readiness reviews.

Changes in management and management systems have affected the development and performance of DOE prime contractor self-assessment programs. Significant changes in senior staffing and management approaches occurred in late 1999 at BNFL. Bechtel Jacobs continues to implement important improvement initiatives designed to more effectively execute the management and integrating contract. Although Bechtel Jacobs fundamental self-assessment concepts have changed little, new implementing procedures were developed and issued in December 1999 and January 2000, and several were being revised during this investigation. Due to identified weaknesses in transitioning from self-performance to subcontract

management, Bechtel Jacobs is placing significant effort on establishing and implementing a new systems integration model. The model is intended to improve the definition of roles and responsibilities, goals and expectations, and standards and applications of processes and procedures. The systems integration effort also includes a comprehensive review of Bechtel Jacobs contract requirements and Work Smart standards against subcontract requirements and Bechtel Jacobs and subcontractor implementing procedures. This effort also involves developing organization charters and restructuring and streamlining the document hierarchy (e.g., plans, policies, procedures, and instructions).

BNFL and Bechtel Jacobs perform a significant number and variety of self-assessments, including management assessments, Bechtel Jacobs SA and STR inspections and appraisals, assessments by Bechtel Jacobs ES&H functional subject matter experts, and independent oversight by the Bechtel Jacobs Performance/Quality Assurance (P/QA) organization. Deficiencies identified during BNFL assessments are documented in NCRs, and corrective actions are formally tracked to closure. For Bechtel Jacobs's ETTP Project (overseeing remediation, D&D, and site infrastructure), dozens of management assessments have been completed since January 2000, some identifying important ES&H problems. The status of corrective action completion is tracked on an assessment log, and significant items for the Bechtel Jacobs prime subcontractor, JA Jones, are tracked separately. Secondary STRs/facility managers are performing walkthroughs, deficiencies are identified, and corrective actions tracked as part of progress review weekly meetings with subcontractors. Some walkthroughs are performed jointly with DOE Facility Representatives, with shared findings input directly into the Issue Corrective Action Tracking System (ICATS). The JA Jones ES&H representative jointly performs documented work area walkthroughs with the Bechtel Jacobs SA.

The Bechtel Jacobs waste disposition project recently issued schedules for project managers and project ES&H staff to conduct management assessments. Bechtel Jacobs ES&H functional management has established and is executing a schedule for management assessments for staff matrixed to projects. For the Waste Disposition Project, the health and safety lead/SA for ETTP, an experienced and knowledgeable industrial hygienist, has conducted some well-planned and documented assessments. Findings related to Bechtel Jacobs and its subcontractors that originate from external sources, such as DOE and independent surveillances, as well as from assessments performed by P/QA, are entered into ICATS and tracked to completion of the corrective actions. The industrial hygiene and industrial safety personnel of Bechtel Jacobs subcontractor WESKEM perform regular inspections and walkthroughs, identify problems, and ensure correction. These safety professionals are also involved with hazard identification and control reviews in the WESKEM work planning process.

As the management and integrating contractor, Bechtel Jacobs must assure that subcontractor organizations are using appropriately trained and qualified personnel to perform safety-related functions. This requires Bechtel Jacobs to assure that the subcontractor management systems and training programs effectively address site hazards and the associated hazard controls. In addition, Bechtel Jacobs personnel who perform a line oversight function must themselves be appropriately trained in site hazards, hazard controls, and work processes. At ETTP these are significant challenges because of the number of subcontractor organizations that are employed by Bechtel Jacobs, which results in numerous work planning and control processes being used at the site. For ETTP subcontractors performing work for a number of organizations across the site, and in a variety of work environments (notably JA Jones), the need for comprehensive training is absolutely paramount.

Systems to ensure that personnel have the requisite training and qualifications to perform work are at various stages of maturity. Most prime contractors have automated systems in place to monitor training requirements, while many of the principal subcontractors are adjusting to the recent transition by reconciling their personnel records and establishing training and qualifications databases. Individuals performing oversight receive formal training and maintain qualifications in a variety of fundamental safety-related areas, including radiological worker, hazardous waste operations worker, environmental protection, waste management, and materials transportation. Bechtel Jacobs has initiated a continuing education program for its safety advocates that includes cross-training initiatives in the academic fields of industrial hygiene and environmental protection. However, a number of weaknesses in contractor and subcontractor training and qualifications programs were identified, which are reflected in performance deficiencies by subcontractors observed by the investigation team and in prior events at ETTP.

Notwithstanding the many positive DOE initiatives and the contractor and subcontractor self-assessment and oversight related elements observed at ETTP, procedural weaknesses exist. Self-assessment and oversight programs have not been consistently or comprehensively implemented. The issues in this section describe fundamental weaknesses in the processes and performance for DOE oversight of ETTP contractors, contractor oversight of its subcontractors, subcontractor self-assessments, and assurance of effective implementation of all DOE regulatory requirements by all organizations.

4.3 Issues

Issue 16. OR has not conducted effective oversight of ES&H to ensure that prime contractors and subcontractors at ETTP comply with applicable ES&H requirements. As line management for the cleanup of ETTP, OR must assure that all cleanup activities are performed in a manner that protects the worker, the public, and the environment. Fundamentally, DOE achieves this objective by setting clear and appropriate expectations as conditions of contracts and by providing oversight to assure that these expectations are met. The oversight of DOE prime contractors by OR is not fully effective because the DOE oversight policy is not implemented at ETTP, prime contracts lack some appropriate requirements, abnormal events are not investigated and reported as required, corrective actions and lessons learned are not always effectively applied, and reviews of contractor performance lack sufficient rigor.

- *Oversight policy has not been fully implemented.* OR has not implemented the oversight policy in DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, or the requirements of OR O 450 Chapter IV, *Environment Safety and Health (ES&H) Oversight Program*. Until recently, the OR ES&H quality assurance program discouraged the performance of ES&H compliance assessments. In December 1999, the oversight program was replaced by a program that required increased monitoring and assessment of contractor compliance with safety requirements (OR Order 450, Chapter IV). However, some important programmatic requirements that are needed to meet the provisions of DOE Policy 450.5, and the requirements of OR Order 450 Chapter IV, are not implemented, and other programmatic requirements are not being rigorously applied. For example, no sitewide operational awareness program exists to monitor contractor performance and analyze findings for crosscutting issues. Some line managers have taken initiatives to improve operational awareness activities, but the quality and rigor of line oversight is inconsistent and incomplete. Walkthrough assessments are conducted by Facility Representatives, subject matter experts, and program managers, but the results are not always documented, and those that are documented indicate inconsistencies in reporting thresholds, report content, and report distribution. There are no procedures for documenting or tracking findings by Facility Representatives. Findings are not analyzed for trends or crosscutting issues. Another key element not implemented is the review of contractor ES&H performance against formally established performance criteria. Reviews of BNFL and DRS safety performance have been performed, but not against formally established performance criteria, and significant deficiencies are evident as reflected in Facility Representative's observations and in occurrence reports. OR has performed few appraisals of contractor safety or self-assessment programs in recent years, and the investigation team found significant weaknesses in these programs; furthermore, OR Order 450 requires periodic program appraisals.

- *Contracts lack appropriate requirements.* Contracts for work at ETTP do not include important DOE safety policy and direction in areas where contractor performance does not meet DOE expectations. Contracts do not require compliance with specific DOE safety management policies and orders, and equivalent requirements are not imposed in several areas where performance problems were evident. Similar concerns were also identified in the May 2000 *Independent Investigation of the Portsmouth Gaseous Diffusion Plant* report.

  - DOE Policy 450.5, *Line Environment Safety and Health Oversight*, issued June 26, 1997, has not been established by OR as a contractual requirement for all prime contractors at ETTP, and OR has not ensured that its prime contractors at ETTP maintained effective oversight over their subcontractors.

- DOE Order 440.1A, *Worker Protection Management*, has not been imposed as a contractual requirement on Bechtel Jacobs or other ETTP contractors, and important provisions of this order have not been addressed at the site. For example, medical professionals have not been sufficiently informed of site hazards.

- DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, has not been identified by OR as an applicable requirement in the Work Smart standards at ETTP. The investigation team identified numerous conduct of operations problems, including weaknesses with shift turnover, procedural compliance, and LO/TO.

- DOE Orders 5400.1, *General Environmental Protection*, and 5400.5, *Radiation Protection of the Public and the Environment*, have not been established by OR as contractual requirements for all prime contractors at ETTP, and therefore programs for environmental radiological protection and surveillance are not fully compliant with these orders. For example, the surface water sampling program at ETTP does not provide for quantification of all discharges of liquids contaminated with radioactivity as required by DOE Order 5400.1, and there is a lack of an environmental ALARA program as required by DOE Order 5400.5.

• *Abnormal event investigation and notifications are not rigorously applied.* OR has not ensured the prompt reporting of many abnormal events as required by DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

The reporting of significant abnormal events, followed by the in-depth investigation, corrective actions, and lessons-learned processes, provides an essential feedback and improvement process that is important to preclude recurrence of the same or similar abnormal events. DOE Order 232.1A requires submittal of a Notification Report "as soon as practical but, in all cases, before the close of the next business day from the time of categorization (not to exceed 80 hours)." Although many abnormal events are being properly reported through the Occurrence Reporting and Processing System (ORPS), it appears that other events and near misses are not being reported to site management, properly categorized, and reported to DOE.

During this investigation, the team observed or became aware of numerous abnormal events that resulted in work stoppages or interruptions and met the reporting criteria of DOE Order 232.1A, none of which were properly reported via ORPS and some of which were not properly investigated. As of June 25, 2000, none of the following "occurrences" had been reported via ORPS as required.

Criterion 3C-ON(2) from DOE Manual 232.1-1A, *Occurrence Reporting and Processing of Operations Information*, specifies that reporting is required for "Any shutdown of a work activity taken as a result of an OSHA violation."

– On March 21, 2000, work was stopped on a trailer movement due to numerous OSHA violations, and concerns (over 30 cited in a March 22, 2000, Bechtel Jacobs memorandum to file) identified by two Bechtel Jacobs Safety Advocates and a DOE Facility Representative. These included working on the roof of a trailer without fail protection, using bald and underinflated tires, failure to wear proper PPE, unsafe traffic control, moving a trailer with a worker inside, and failure to use ground fault protection.

– On June 9, 2000, the investigation team observed the overloading of a forklift vehicle that was subsequently removed from service. (See Issue 7 in Section 3.1.)

– On June 15, 2000, at the DOE Federal Building, the investigation team observed the lack of barriers in place around an open elevator shaft that resulted in a work stoppage. Criterion 10B-UO(1) – "A near miss," would also apply. (See Issue 7 in Section 3.1.)

– On March 26, 1999, work was stopped in the area where Building K-1131 was demolished due to a major pressurized fire protection water line breech while performing D&D. The cause of the water release was due to an inadequate LO/TO on the fire water system. Criteria 2E-ON(2) – "Any occurrence under any agreement or compliance that will be reported to outside agencies in a format other than routine periodic reports" – would also apply.

– On and before June 12, 2000, the investigation team observed numerous LO/TO violations that caused work to be stopped. (See Issue 7 in Section 3.1.)

Criterion 3A-ON(3) from DOE Manual 232.1-1A, *Occurrence Reporting and Processing of Operations Information*, specifies that reporting is required for "Personnel exposure in a single event to hazards in excess of limits, as established by OSHA or ACGIH."

- On June 14, 2000, the investigation team observed BNFL workers at the K-33 Building exposed to high impact noise that the team's analysis determined likely exceeded the TLV ceiling limit. BNFL had determined in November 1999 that peak levels registered on noise dosimeters and meters were reaching 140-146 dBA, but this information was not identified in BNFLs deficiency tracking system and no corrective action was taken. After the June 14 observation by EH BNFL took noise level readings. And on June 26, after prompting by EH, reported this occurrence to DOE. DOE 232.1A requires timely identification, categorization, investigation, and reporting of unusual conditions and events to DOE and specifies that events be reported "as soon as practical but, in all cases, before the close of the next business day from the time of categorization (not to exceed 80 hours)." (See Issue 13 in Section 3.4.)

• *Corrective actions and lessons learned have not always been effectively applied.* Repetitive deficiencies continue to occur because corrective actions were not effective in addressing underlying causes. Safety deficiencies have continued at ETTP because of the failure to adequately review and apply lessons learned from other sites. The Office of Oversight previously noted weaknesses in this area in a 1997 management assessment at ETTP.

- Repetitive violations of requirements by DOE contractors and subcontractors at ETTP indicate ineffective corrective actions. For example, OR identified numerous violations of hoisting and rigging requirements by BNFL from May 1998 through April 2000. BNFL line management failed to take action to prevent recurrence. Similarly, from December 1997 through August 1999, OR identified recurring deficiencies in the BNFL self-assessment process for readiness reviews. OR oversight activities were effective in identifying numerous significant deficiencies in BNFL programs and practices; however, the value of this oversight was limited by less than adequate commitments for corrective action and recurrence control.

- Lessons learned from previous events have not always been effectively translated into corrective actions. For example, the new oversight program that was developed as a lesson learned from a Type B accident investigation at ETTP in March 1999 has not fully been implemented. The 1997 Oversight assessment of ETTP cited ineffective follow-up by OR in assuring implementation of corrective actions. In addition, inadequate reporting of abnormal events in ORPS was previously identified during that assessment

Building K-33 Facing Southeast

Although corrective actions were completed in 1998, these corrective actions were not effective, as detailed above.

- The investigation team noted that performance deficiencies at ETTP were similar in many respects to deficiencies that had existed at Paducah and Portsmouth. For example, Paducah and ETTP exhibited weaknesses in radiological control program technical bases, characterization of radiological hazards, and use of RWPs. Occupational medicine programs were also deficient in that they did not include provisions for informing medical professionals of site hazards. Significant deficiencies in the content and execution of work planning and control processes and in the maintenance of UF_6 cylinders were also evident at both Paducah and ETTP. In addition, the ETTP programs for environmental radiological protection and surveillance were found to be not fully compliant with DOE Order 5400.5 and 5400.1 requirements, impacting the site's ability to properly evaluate and consider alternative approaches to managing radiological contaminants. The lack of a formal environmental ALARA program is a deficiency that was identified at ETTP during a 1991 Tiger Team assessment. However, the investigation team also noted evidence that numerous steps have been taken to address these common deficiencies at ETTP and included the strengthening of training, procedures, and guidance documents.

Need for Follow-up to OR ISMS Verification Review of Bechtel Jacobs. The EH investigation team examined the Combined Phase I/II ISMS Verification for Bechtel Jacobs conducted by OR in January and February 2000. The EH investigation team evaluated the objectives and criteria applied, the scope of the reviews performed, and the evaluations and conclusions drawn from both the data and analysis in that report as well as the findings of this investigation team. The EH investigation team determined that the conclusions for some of the Phase I and II objectives and criteria were not sufficiently supported by the details of the reviews contained in the verification report, or by the results of the three investigations of gaseous diffusion plants performed by EH. The 36 opportunities for improvement identified in the verification report collectively reflect significant deficiencies in the development of the ISMS programs and procedures. The EH investigation team has also identified a number of weaknesses in some elements of ISM, which are documented in this report, notably in the areas of work planning, requirements management, procedure adherence, training, and feedback and improvement. The deficiencies in ES&H programs and performance detailed in this investigation report further indicate that considerable weaknesses remain in Bechtel Jacobs ISMS programs and procedures, as well as in their implementation (Phase II). While OR maintains that Phase I objectives and criteria have been met, collectively, the opportunities for improvement in the OR Phase I/II verification report combined with the weaknesses identified in this investigation and previous investigations from Paducah and Portsmouth indicate a number of areas that warrant management emphasis and attention to ensure additional improvements in the Bechtel Jacobs ISMS are achieved. OR is planning to perform an independent follow-up review to ensure that Bechtel Jacobs has effectively addressed both the ISMS opportunities for improvement identified by the verification review and those weaknesses identified by the EH investigation team as part of rendering an overall judgment as the level of implementation of the Bechtel Jacobs ISMS. OR's planned independent review to ensure that Bechtel Jacobs has effectively addressed identified ISM weaknesses will require a broad-based and in-depth evaluation of the adequacy of policies, plans, procedures, and mechanisms down to the task level (i.e., subcontractor) as specified in DOE-HDBK-3027-99.

Issue 17. ETTP prime contractors and subcontractors have not established or implemented effective self-assessment and oversight programs that ensure consistent performance in accordance with contract, regulatory, and procedural requirements, and integrated safety management policy. Although many oversight activities are being performed and ES&H deficiencies are being identified and corrected, many key elements of self-assessment and oversight of contractor and subcontractor performance are being inconsistently and incompletely performed. Weaknesses were identified in the adequacy of procedures, scheduling and performance of surveillances and assessments, identification and

tracking of deficiencies, trending of deficiencies, staffing, training, readiness evaluations, and lessons learned.

Bechtel Jacobs

- *Several oversight procedures are inadequate*. The procedures for independent and management assessments do not require the issuance of non-conformance reports for deficiencies that meet the definition of a non-conformance in procedure PQ-A-1440.

- *Scheduling of oversight activities is inadequate*. ETTP has not established a schedule for P/QA performance monitoring as required by procedure and has performed only limited, poorly documented surveillances and walkthroughs. The four Waste Disposition project performance-monitoring surveillances performed in calendar year 2000 have been limited to the waste certification program. The scheduling for ETTP project management assessments is rudimentary and does not specify subject area or responsible assessor, and most activities are added to the "schedule" after performance. Not all Waste Disposition project management assessment schedules and reports have been identified, reviewed, and forwarded to the assessment coordinator as required by procedure. There is no master listing of the population of managers responsible for performing management assessments, nor is there a composite schedule of management assessments as required by procedure. The extent and scope of management assessment and performance monitoring being identified varies from project to project. Mandatory annual assessments of the LO/TO program have not been performed by the ETTP project, and not all walkthroughs are being documented as required by procedure.

- *Tracking of issues is inconsistent*. P/QA review of deficiencies for inclusion into ICATS is not always timely. The threshold for input of deficiencies into ICATS is lower for P/QA and externally generated "issues" than for management assessments (which must be deemed "significant"), preventing valid trend analysis. Findings identified by project management and ES&H personnel are not being properly screened for inclusion in ICATS. Further, there is no consistent or trendable system(s) for tracking less-significant deficiencies that are not tracked in ICATS.

- *Trending of the deficiencies in ICATS is not being performed*.

- *P/QA staffing deficiencies were identified*. The staffing level for the Waste Disposition project P/QA has been insufficient to implement oversight program requirements effectively. An additional contractor quality engineer has recently been hired, which should enable the project to perform the level of surveillance required by procedure. Bechtel Jacobs P/QA depends heavily on contractors to perform independent assessments while direct employees are focused on programmatic and administrative matters. Bechtel Jacobs must be careful to ensure that enough staff are involved in direct assessment activities to adequately monitor performance.

- *Oversight process training is lacking*. There has been no formal orientation or training for the personnel responsible regarding the expectations and requirements for performing assessments, beyond required reading of company level procedures. The Bechtel Jacobs self-assessment program is relatively new, involves several related procedures (e.g., assessment, non-conformance reporting, and issues management), and involves managers and others not schooled or experienced

Building K-1015 (Laundry) North Side

in assessment techniques. The necessary training on oversight and self-assessment requirements does not appear to be planned.

- *Readiness reviews are inadequate*. Contractor and subcontractor readiness evaluations were not sufficiently rigorous to identify fundamental problems in ES&H programs and processes. The readiness review for JA Jones was not performed before the start of the contract as desired, but rather was partially performed over several months after work started. This delayed the identification of significant weaknesses in JA Jones ES&H programs. Although a readiness evaluation was performed for WESKEM which identified pre- and post-start action items, it failed to identify weaknesses in its self-assessment program and insufficient staffing to implement and administer the oversight and self-assessment functions. Further, there was no planned, prioritized, focused evaluations of ES&H program implementation conducted after the WESKEM notice to proceed was issued.

BNFL, Inc.

- *Assessments lack rigor*. Management and independent QA assessments are not always rigorous enough to identify the problems that were identified by the Oversight team, and corrective actions to previously identified deficiencies have not been effective in preventing recurrence.

- *ES&H reviews are not documented*. Day-to-day ES&H performance monitoring by health and safety professionals is not documented in a manner that allows issue tracking or trending. Although the industrial hygienist and the assistant health and safety officers spend much of their time in the field observing work, their activities and observations are documented in various personal log books. This approach makes management and oversight review cumbersome and bypasses the corrective action tracking system for the management of performance deficiencies.

- *The lessons-learned program has weaknesses*. The actions to be taken by BNFL that are recommended by the lessons learned coordinator are included in the same column as the recommended actions and actions taken by the originating organizations, making it difficult to identify what actions relate to BNFL. Further, there is no feedback loop to the coordinator, or follow-up by the coordinator, to document the evaluation, actions taken, or actions recommended by the BNFL recipients of the lessons learned.

- *Tracking and trending of issues are inadequate*. There are weaknesses in the identification, evaluation, and management of ES&H issues. Findings from some management evaluations have not been appropriately documented and input to the BNFL corrective action tracking system. The disposition of some near miss/hazard identifications have not been documented and communicated to workers, and the corrective actions taken for other items are not clearly identified. Although previously identified deficiencies from internal and external sources were categorized in mid-1999, there was no formal or documented analysis of that data to identify adverse trends, adequacy of corrective actions and recurrence controls, areas needing additional assessment, or differences between internal and external findings.

JA Jones

- *The self-assessment program is weak*. JA Jones has only recently established this program, and its performance to date has been minimal and lacks the rigor required to identify and prevent ES&H performance deficiencies. JA Jones, the maintenance support subcontractor to Bechtel Jacobs since November 1999, did not establish a self-assessment program at the start of the contract as required. Bechtel Jacobs authorized work to begin without that program in place and did not identify this as a deficiency. The lack of a self-assessment program was identified in a management assessment performed by JA Jones corporate offices in January 2000. Corrective actions to establish the self-assessment program procedures were completed in April, and the first JA Jones ETTP project level management assessment was completed in May. However, this assessment was limited in scope, addressing only the document control process and identified one minor deficiency. In contrast, Bechtel Jacobs conducted several assessments of JA Jones' ISMS processes during April 2000 and identified a number of significant weaknesses. These

weaknesses included inconsistency in developing job packages; incomplete definition of the lessons-learned program; inconsistent use of available tools by planners and supervisors to identify the hazards associated with tasks; inconsistent coordination of work efforts; failure of supervisors to obtain work-start authority from building operators or facility managers; incomplete documentation of the hazard communication program; and deficiencies in the training program. JA Jones has been mostly reactive to external assessments and oversight from Bechtel Jacobs and has not dedicated the resources necessary to develop a strong, proactive self-assessment program. Management self-assessments are now scheduled monthly for the remainder of the year and focus on areas identified as having significant weaknesses, including the work control program, equipment testing and inspection, and the hazard communication program.

- *Procedures for tracking and trending issues are lacking*. There is no procedure or formal system detailing requirements for capturing, tracking, and trending deficiencies and corrective actions. Newly identified deficiencies are now added to a database that was initially used for tracking items for a management assessment.

- *Independent surveillances by QA required by procedure PRO-303.03 have not been scheduled or performed.*

- *The ES&H Representative has not been documenting surveillance and inspection activities as required by Appendix G of the Bechtel Jacobs-JA Jones contract.*

WESKEM, LLC

- *The self-assessment program is inadequate*. WESKEM has not developed and implemented a formal and effective self-assessment and subcontractor oversight program. Although basic ES&H plans and many pertinent procedures have been issued, essential elements of an effective ES&H program are incomplete and performance is inadequate.

- *Independent assessments are not being performed.* Independent assessments required by procedure—the QA Project Plan, the Price-Anderson Amendments Act (PAAA) QA Implementation Plan, and the HASP—have not been planned or performed.

- *Assessment procedures and schedules are lacking.* There is no procedure detailing the requirements for management assessments, and none have been performed. A schedule for three quarterly assessments by the industrial hygiene specialist and the Health and Safety Manager was issued during this investigation, but did not include industrial safety functions. There is no structured process to assure that all pertinent ES&H functions will be reviewed at the appropriate frequency. There are no procedures that describe the responsibilities and processes for industrial safety and industrial hygiene inspections and surveillances. Documentation of inspections and walkthroughs by the industrial hygiene and industrial safety specialists and the resulting concerns/deficiencies is informal and inconsistent.

- *There is inadequate tracking and trending of issues*. There is no procedure detailing a corrective action tracking process and no effective system in place to track and trend identified deficiencies and corrective actions. A database intended initially to track deficiencies lists a total of six open and closed items, but was not being kept current and did not capture all deficiencies. At the time of this investigation, a separate listing was being used to track corrective actions for a recently completed OR waste certification program audit. WESKEM relies on the Bechtel Jacobs ICATS to track their corrective actions for occurrence reports.

- *Self-assessment plans and procedures are not consistent.* The procedure on non-conforming items and corrective actions does not address determining root causes or recurrence control. Details in the QA Project Plan and HASP, including organization of the ES&H functions and descriptions of the assessment program, do not reflect actual conditions or existing procedural requirements.

- *The QA program lacks personnel resources.* The QA manager is responsible for many functions, including the QA program, environmental compliance, regulatory and safety assessments,

permitting, and corrective action tracking for three Oak Ridge operations. The QA manager has had no in-house or contracted staff support to manage and execute an effective self-assessment and independent oversight program.

- *The lessons-learned program has not been established.* The WESKEM lessons-learned program procedure was still in draft form at the time of this investigation, and none of its elements are being applied.

Issue 18. Programmatic weaknesses exist sitewide in training and qualification programs, and weaknesses in training effectiveness contributed to a lack of understanding of and compliance with safety requirements, involving several instances of unsafe work. A trained and qualified workforce is the first line of defense in performing work safely and ensuring effective ISM implementation. Effective training and qualification activities must ensure that workers recognize and respond appropriately to hazards and must address the specific hazards at the job site. At ETTP this is a difficult challenge because of the range of hazards encountered by the workforce (e.g., nuclear, radiological, hazardous, industrial), the age of the facilities, the overlap of many organizations, and the variety of environments in which personnel must work. Culture, attention to detail, and compliance with requirements are an integral part of the training program, along with measurement of training effectiveness through oversight and assessment. The investigation team determined that weaknesses in training and qualification programs contributed to workers' lack of understanding of hazards and/or implementation of requirements associated with some operations and activities.

- *There are deficiencies in the DOE training program.* OR and Site Office personnel overseeing contractor activities and operations at ETTP lack formal training in some safety areas that are essential to effectively perform this function. Although OR personnel are experienced professionals with varying levels of knowledge of safety hazards and associated precautions, most Facility Representatives and subject matter experts have not been adequately trained to evaluate areas such as LO/TO, fall protection, confined space, hoisting and rigging, or lead and asbestos programs. Furthermore, formal system that are in place do not ensure that these individuals maintain a current knowledge base. Site Office program personnel's participation in "walkthroughs" of environmental management activities and operations is minimal, so they make only a limited contribution to oversight. Most program personnel also lack formal training in industrial safety and industrial hygiene program areas. Additionally, no mechanism is in place to ensure that either OR or ETTP Site Office personnel maintain qualifications in these safety areas, since they are not specifically addressed in their respective individual development plans.

- *There are weaknesses in Bechtel Jacobs SA training.* Deficiencies in Bechtel Jacobs' training program contribute to inadequate oversight of subcontractor operations and activities. Most safety advocates do not have current qualifications in supplemental safety areas and thus cannot adequately address their assigned activities or support oversight assignments outside of their designated area. Such supplemental areas include fall protection, confined space, PCBs, hoisting and rigging, lead, asbestos, and LO/TO. Although cross-training initiatives and other supplemental training provided to SAs are noteworthy, they do not compensate for the lack of formal training in the aforementioned safety-related areas. For example, SAs either did not fully understand or did not enforce excavation procedure requirements, resulting in a suspension of work at Building K-1303. (See Table 3 in Section 3.1.)

- *Bechtel Jacobs oversight training in inadequate.* Bechtel Jacobs personnel performing oversight, including SAs, STRs, QA staff, and other line management personnel, are not provided formal instruction on the rigor and specificity needed to assess implementation of procedural requirements. Accordingly, oversight assessments lack consistent depth and breadth of coverage. During this investigation, a WESKEM industrial hygiene technician who was responsible for sampling explosive gases from ST5 containers storing batteries lacked rudimentary knowledge of how to operate the multi-gas survey meter being used. Bechtel Jacobs is planning to initiate a rigorous assessment of subcontractor training programs in July or August 2000, and WESKEM is among the organizations to be reviewed.

- *Contractor training is not in accordance with requirements*. Bechtel Jacobs does not ensure that its subcontractors comply with contractual training requirements. Work area-specific chemical hazard training is not being conducted or documented by Bechtel Jacobs subcontractors as required by 29 CFR 1910.1200 and Bechtel Jacobs procedures.

- *Subcontractor training documentation systems are inadequate*. Principal subcontractors to Bechtel Jacobs have not established effective systems to ensure that all personnel are adequately trained to perform work. An automated database of training records for SEC personnel inherited from Bechtel Jacobs is obsolete. Reliance on hard copy files is cumbersome and not timely. For example, a radiological control technician was assigned to work in an asbestos-contaminated space without appropriate qualifications; however, his lack of appropriate training was inadvertently discovered and his deployment was cancelled. Additionally, SEC does not have a system to identify and capture changes in regulations to ensure that personnel are trained and retrained consistent with current safety requirements. Consequently, the confined space qualifications of some SEC industrial hygiene personnel are not based on current OSHA regulations, and the need for refresher training to update their knowledge and competence has not been recognized. Further, plans have not been developed to ensure that there are sufficient numbers of SEC radiological control personnel are qualified to perform work in asbestos-contaminated environments; as the qualifications of many staff have expired, and the surge in demand for qualified personnel expected in the summer of 2000 was not adequately addressed.

  Development and implementation of an automated training records database for JA Jones personnel are lagging the work being performed sitewide. Supervisors must continually confirm employee qualifications by contacting the training records coordinator before dispatching individuals to assignments. A hard-copy training records file system was recently completed after reconciling discrepancies identified in the database inherited from Bechtel Jacobs. Formal instruction in nuclear criticality safety remains absent from the training requirements matrix; Bechtel Jacobs previously identified this weakness in May 2000. Personnel are not adequately trained on procedural requirements and effective coordination on multi-contractor tasks, as evidenced by the recent work stoppages involving utility disconnects due to this investigation team's LO/TO concerns at an excavation site.

- *Building operator training is inadequate*. WESKEM does not have a formal training program for its building operators. It relies upon on-the-job training, which does not provide consistent information. Consequently, WESKEM building operators do not have a clear understanding of their roles and responsibilities. This lack of understanding has contributed to building safety deficiencies, including unknown chemicals and orphaned containers of legacy waste stored in K-1065D. In addition, ATI/FMSIT has not effectively trained its building operators to follow procedures that define their roles and responsibilities. Accordingly, there are a variety of building safety deficiencies in K-1004D and K-1035, including emergency plans that do not reflect the presence of chemical hazards, incomplete surveillance checklists, and uncharacterized locked spaces.

- *Hoisting and rigging competencies are weak*. WESKEM personnel's competence in hoisting and rigging operations is suspect. Workers were found not to follow procedural requirements for overhead lifts and forklift activities. OR also identified numerous BNFL violations of hoisting and rigging requirements.

4.4 Summary and Conclusions

The complex relationships among DOE and the multiple contractors and their subcontractors performing work at the site present many unique challenges to line management and the workforce in executing the site's mission and in implementing ISM. Some important actions have been taken by line management to address sources of contamination from past plant operations. While the pace of site remediation has been slow, notable progress has been made in the D&D of buildings, and ongoing efforts are being made to decontaminate other buildings to further reduce site hazards that resulted from legacy operations. Overall, the site has maintained a good worker safety and health record when compared to industry and other DOE

facilities. The level of work activities, especially in D&D, remediation, and reindustrialization is likely to increase with a proportional increase in risk to workers. The workforce is generally motivated and competent, and performs a significant amount of work in a safe and professional manner. Interviews with managers, workers, and safety personnel indicate that safety is a priority over production and schedule, and personnel appropriately demonstrated stop work authority on several occasions during the investigation.

Recent initiatives involving policy, procedures, personnel, and training directed at strengthening oversight clearly indicate awareness by EM and OR management of the need to improve performance in this area. Most ETTP line managers accept responsibility for safety and understand the value of effective contractor oversight. In contrast to other Bechtel Jacobs sites, there is an increased amount of OR operational awareness activities to monitor contractor performance at ETTP. Operational awareness provided by facility representatives, especially for BNFL activities, provides valuable feedback to line management on contractor performance and correction of deficient performance. Subject matter experts assigned to the ETTP Site Office have identified and caused correction of many safety deficiencies. Bechtel Jacobs, in its role as management and integrating contractor, has initiated an extensive review and modification of organizational structures, roles and responsibilities, policies, and procedures in developing and implementing a new systems integration model. The new model is intended to address management challenges associated with the transition from self-performed work to oversight of subcontracted work.

DOE Order 450.4, issued in December 1999, delineates the responsibilities, expectations, and requirements for conducting oversight of ES&H activities. OR, contractors, and subcontractors generally have established the basic organization, requirements, and commitments in plans or implementing procedures to conduct sufficient self-assessment and oversight, and many assessment and oversight activities are being performed. However, execution of the ES&H management, oversight, and self-assessment functions has been inconsistent, and not always effective in identifying, correcting, and preventing recurrence of programmatic and performance deficiencies. Not all elements in DOE Order 450.4 have been fully implemented by line management. Contracts do not include provisions requiring prime contractors to provide oversight of their subcontractors, as delineated in OR Order 450 and DOE Policy 450.5. OR is not adequately performing all required DOE field assessment and appraisal activities. Although many and various assessment and oversight activities are being performed by ETTP facility representatives and subject matter experts, their activities were not always controlled by formal procedures or processes, and line management has not always provided sufficient direction on priorities, areas of focus, and frequency of review. DOE and its contractors do not properly document and collect all deficiencies to support effective cause analysis and recurrence control, trending, and tracking of corrective actions. In addition, lessons learned from previously identified programmatic and performance deficiencies have not always been communicated to new contractors and applied to the new ways of managing work at ETTP.

In a number of areas examined by the investigation team, the guiding principles and core functions of ISM, as detailed in DOE Policy 450.4, *Safety Management System Policy*, have not yet been integrated into ETTP policies and procedures and have not been fully implemented by the program offices, OR, prime contractors, or its subcontractors. OR has not always ensured that, before work commences, contractors and subcontractors have sufficient programs in place to ensure ES&H requirements will be met and workers, the public, and the environment are protected. Contracts and subcontracts do not always contain sufficient requirements to assure an acceptable level of ES&H performance in some areas, and management and oversight of environmental restoration and management programs have not been fully effective in prioritizing work and ensuring compliance with requirements. In particular, maintenance and disposition of UF_6 cylinders have not received adequate management attention and resources, potentially impacting DOE commitments to the DNFSB and the State of Tennessee's Consent Orders. In addition, deficiencies in sampling and monitoring of air pollutant emissions from ETTP facilities also indicate a lack of effective and rigorous line oversight. Further, some ES&H vulnerabilities associated with reindustrialization related activities remain, especially the lack of formal authority and control over OMI performing infrastructure maintenance that can affect DOE operations, including radiological and hazard category 2 nuclear facilities.

DOE and contractor line management are taking many appropriate and positive steps to strengthen line oversight of contractor performance. Senior management commitment to integrated safety management is evident, and has been demonstrated through appointment of line managers with enhanced operational experience and by setting higher expectations for their field presence. The Assistant Secretary for Environmental Management issued a management guide to encourage managers to perform work area walkthroughs; the OR Manager has recently issued a similar guide and reinforced expectations by personally conducting facility walkthroughs. Notwithstanding these positive actions, further progress is limited by DOE and contractor management initiatives and systems that are not yet fully developed nor sufficiently focused on ensuring the effectiveness of line self-assessment processes and implementation of contractual requirements. Although most work activities are probably conducted safely, unsafe work observed by this investigation and by OR operational awareness activities indicate a need for more effective line management oversight and additional rigor in the implementation of safety requirements. Many work performance deficiencies identified by the investigation team involved procedure adherence issues. Weaknesses in training programs contribute to workers' lack of understanding of hazards and/or implementation of requirements and procedures for some work activities, and the effectiveness of oversight. The failure to follow procedures is chronically the primary cause of unsafe work practices and worker injuries and may be a precursor to more significant safety events. Increased management attention is required to ensure that management systems and contractor initiatives are fully developed, rigorously applied, and achieve an adequate level of compliance with safety requirements, including full implementation of DOE Policy 450.5, *Line Environment, Safety, and Health Oversight.*

APPENDIX A
ISSUES FOR CORRECTIVE ACTION AND FOLLOW-UP

Line management is responsible for correcting deficiencies and addressing weaknesses identified in Office of Oversight reviews. Following each review, line management prepares a corrective action plan. The Office of Oversight follows up on significant issues as part of a multifaceted program that involves follow-up reviews, site profile updates, and tracking of individual issues.

This appendix summarizes the significant issues identified during the investigation of current ES&H programs at ETTP. The issues identified in Table A-1 will be formally tracked in accordance with the DOE plan developed in response to the Defense Nuclear Facilities Safety Board Recommendation 98-1, which addressed follow-up of independent oversight findings. OR, Bechtel Jacobs, BNFL, DRS, and M&EC need to specifically address these issues in the corrective action plan. The issues in this report necessarily reflect the results of the specific programs and organizational elements evaluated. The Office of Oversight believes that many of the issues may, in fact, have broader application to ETTP organizations beyond those specifically identified in the issue statement. Accordingly, the Office of Oversight recommends that DOE ensure that all ETTP organizations examine their safety management systems and programs with respect to the issues identified in this investigation, and, if it is determined that the issues do apply, then take necessary corrective actions.

During an investigation, the Office of Oversight team may identify isolated weaknesses and/or minor deficiencies in otherwise effective programs. Although the site needs to correct such weaknesses and deficiencies, the Office of Oversight does not include every identified weakness in the formal tracking system. However, all weaknesses and deficiencies are considered as part of the Office of Oversight follow-up program when evaluating performance and planning future Oversight evaluation and follow-up activities.

Table A-1. Issues Identified During the Investigation of ETTP

IDENTIFIER	ISSUE STATEMENT	REFER TO PAGES
ETTP-INV-00-01	Weaknesses in the environmental restoration program at the ETTP site include ongoing delays in remedial decision-making, incomplete identification and evaluation of past potential disposal and release locations, incomplete ground-water contamination characterization, and the absence of effective mitigation actions for continuing releases of chemical and radiological contaminants.	12
ETTP-INV-00-02	The Office of Nuclear Energy, Science and Technology (NE) and OR have not placed sufficient priority on the maintenance of depleted UF_6 cylinders and cylinder yards at ETTP.	17
ETTP-INV-00-03	Weaknesses in the sampling and monitoring of air pollutant emissions from ETTP facilities raise concerns regarding the accuracy of public dose and exposure calculations.	18
ETTP-INV-00-04	The process for release of areas and equipment from radiological control at ETTP is not sufficiently defined or implemented.	20
ETTP-INV-00-05	ETTP programs for environmental radiological protection and surveillance are not fully compliant with DOE Order 5400.5 and 5400.1 requirements.	23
ETTP-INV-00-06	Legacy mixed waste, LLW, and scrap/surplus material storage areas and containers have not been consistently characterized or maintained, and current mixed and sanitary waste management programs are not consistently implemented by DOE, Bechtel Jacobs, DRS, and subcontractors.	24

Table A-1. Issues Identified During the Investigation of ETTP (Continued)

IDENTIFIER	ISSUE STATEMENT	REFER TO PAGES
ETTP-INV-00-07	Inadequate implementation of work control programs by DOE, Bechtel Jacobs, other prime contractors, and CROET/OMI resulted in inadequate hazard identification and analysis, inadequate implementation of established controls, and failure to follow approved procedures that contributed to several unsafe work practices observed by the investigation team.	41
ETTP-INV-00-08	The failure of OR to include DOE Order 5480.19 or equivalent requirements as a part of the Work Smart standards for the ETTP prime contractors and subcontractors has resulted in numerous conduct of operations problems in several areas, including shift turnover, procedural compliance, and lockout/tagout.	44
ETTP-INV-00-09	OR has not ensured that prime contractors develop, implement, and maintain radiation protection programs with sufficient rigor and formality, resulting in increased potential for unnecessary exposures to workers.	46
ETTP-INV-00-10	DRS did not take appropriate and aggressive actions to evaluate or reconcile potential personnel exposures to transuranic isotopes during D&D work at Building K-1420, resulting in potential unevaluated exposures to workers.	50
ETTP-INV-00-11	The identification, understanding, and implementation of some contract requirements for safety and health by Bechtel Jacobs and its subcontractors and DRS are not adequate to ensure the protection of the workers.	52
ETTP-INV-00-12	Activity and building hazard analyses and processes performed by BNFL, Bechtel Jacobs, and their subcontractors lack adequate and/or timely identification, documentation, and communication of some hazards, which have contributed to an instance of worker overexposure to a physical health hazard.	53
ETTP-INV-00-13	Activity-level hazard controls for some activities, although documented in work packages and hazard analyses, are not effectively implemented by BNFL, DRS, Bechtel Jacobs, or their subcontractors, resulting in some requirements not being met or engineering controls not being effectively implemented.	54
ETTP-INV-00-14	Bechtel Jacobs, WESKEM, and ATI facility managers and building operators do not have or exercise sufficient control over building occupants, tenants, and activities to ensure that hazards are identified, evaluated, mitigated, and/or controlled.	55
ETTP-INV-00-15	OR has not ensured that all ETTP contractors and their subcontractors meet the requirements of DOE Order 440.1A, *Worker Protection Management*, Chapter 19, Occupational Medicine Programs (or equivalent), which establishes a comprehensive medical program that is necessary to protect workers and promote a healthy work environment.	55
ETTP-INV-00-16	OR has not conducted effective oversight of ES&H to ensure that prime contractors and subcontractors at ETTP comply with applicable ES&H requirements.	61
ETTP-INV-00-17	ETTP prime contractors and subcontractors have not established or implemented effective self-assessment and oversight programs that ensure consistent performance in accordance with contract, regulatory, and procedural requirements, and integrated safety management policy.	64
ETTP-INV-00-18	Programmatic weaknesses exist sitewide in training and qualification programs, and weaknesses in training effectiveness contributed to a lack of understanding of and compliance with safety requirements, involving several instances of unsafe work.	68

APPENDIX B
TEAM COMPOSITION

To reflect the investigation team's overall mission of determining whether historical ES&H activities and practices were consistent with the knowledge, standards, and local requirements applicable at the time and whether current work practices for DOE-controlled areas of ETTP are sufficient to protect workers, the public, and the environment, investigation activities were organized into two groups: management and worker safety, and environmental management. Each group was composed of a group leader and individual members with relevant expertise. Each group developed lines of inquiry that guided the evaluation scope of interest for that group.

The team composition and areas of responsibility are shown below.

Senior Managers

S. David Stadler, Ph.D.
Raymond Hardwick

Team Leader

Patricia Worthington, Ph.D.

Management and Worker Safety Group

Brad Davy - Group Leader
Marvin Mielke, RN, MSN
Bill Cooper, CSP
Bill Miller
Larry McCabe, PE, CSP
Bob Freeman
Ivon Fergus
Connie Eimer
Regina Griego
David Berkey*
Robert Compton*
Ed Stafford*
Al Gibson*
Joseph Lischinsky, CHMM*
Tim Martin, PE*
Mark Good*
Jim Lockridge, PE, CIH, CSP*
Ron Stolberg, CIH, CSP

Environmental Management Group

Bill Eckroade, REM – Group Leader
Vic Crawford, PE, REM
Arlene Weiner, REM*
Mario Vigliani, CHP*
Tom Naymik, Ph.D., CPG, RG*
Chris Perry, CPG, RG*
William Davis*

Communications and Support

Mary Anne Sirk
Barbara Harshman
Brenda Holder
Vikki Hanks
Bob McCallum
Kathy Moore

Quality Review Board

S. David Stadler, Ph.D.
Raymond Hardwick
Frank Russo
Thomas Staker

* Technical Advisor

CHMM – Certified Hazardous Materials Manager
CHP – Certified Health Physicist
CIH – Certified Industrial Hygienist
CPG – Certified Professional Geologist
CSP – Certified Safety Professional
MSN – Master of Science in Nursing
PE – Professional Engineer
REM – Registered Environmental Manager
RG – Registered Geologist
RN – Registered Nurse

(Not Pictured: Mary Ann Sirk, Barbara Harshman, Brenda Holder, Vikki Hanks, Connie Eimer, Ivon Fergus, and Kathy Moore)

The Investigation Team